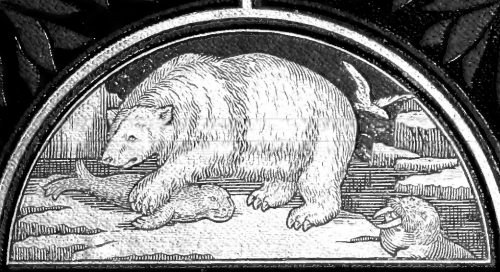

The Royal Natural History

by

Richard Lydekker

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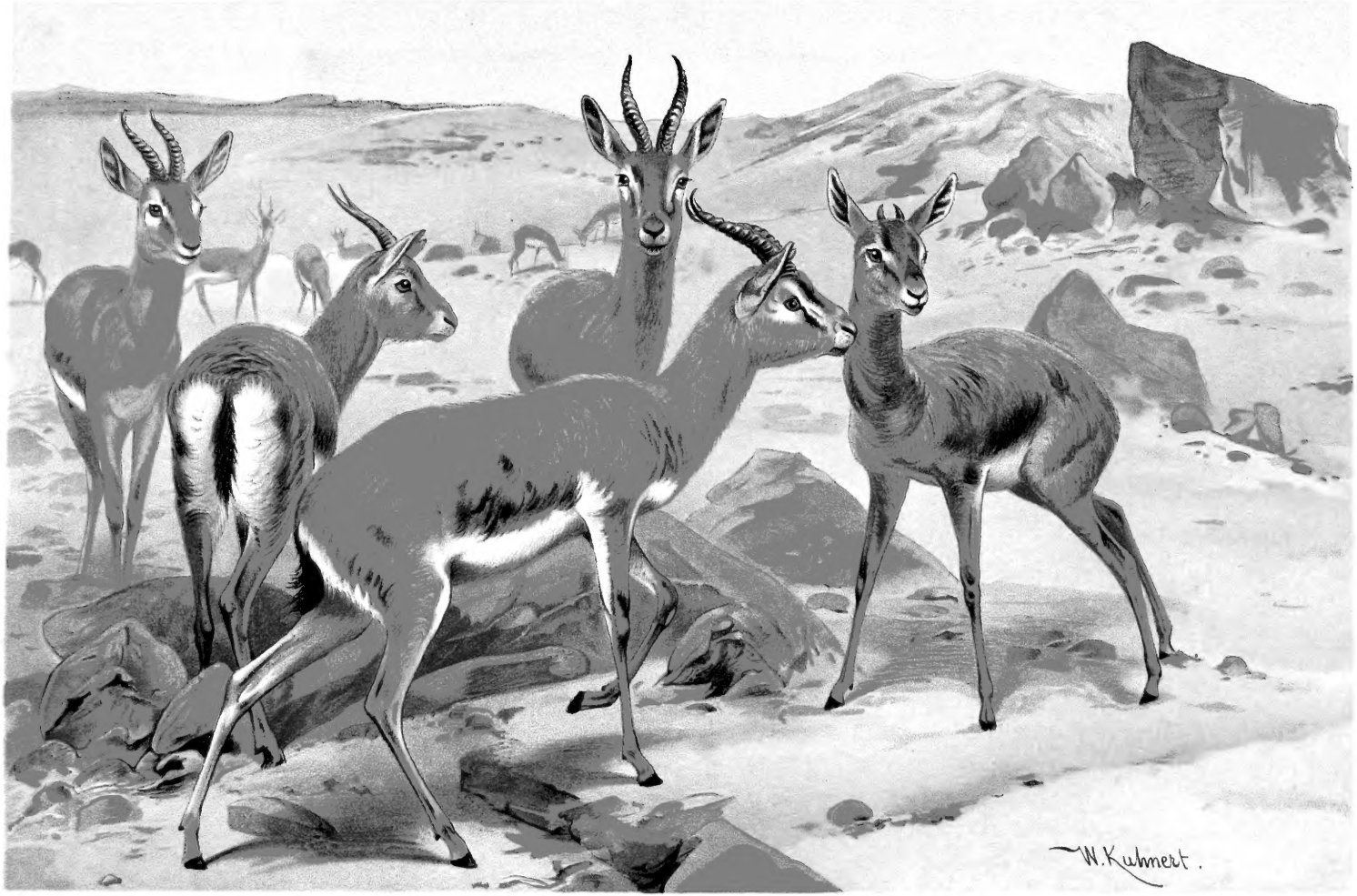
THE ROYAL NATURAL HISTORY



DORCAS GAZELLE.

THE ROYAL NATURAL HISTORY

EDITED BY

RICHARD LYDEKKER, B.A., F.R.S., ETC.

WITH PREFACE BY

P. L. SCLATER, M.A., PH.D., F.R.S., ETC.

SECRETARY OF THE ZOOLOGICAL SOCIETY OF LONDON

ILLUSTRATED WITH

Seventy-two Coloured Plates and Sixteen Hundred Engravings

BY

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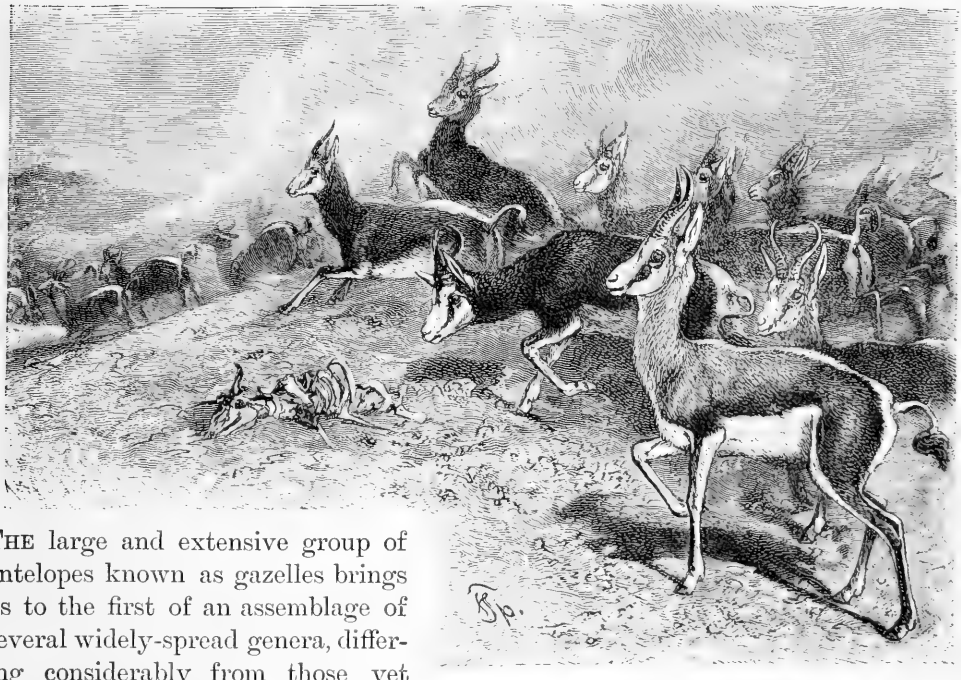
CHAPTER XXI.

The Ungulates,—*continued.*

The Hollow-Horned Ruminants,—*continued.*

The Gazelles. Genus *Gazella.*



A "TREK" OF SPRINGBOK.

The large and extensive group of antelopes known as gazelles brings us to the first of an assemblage of several widely-spread genera, differing considerably from those yet noticed. Most of these antelopes are of small or moderate size, and the majority of them are inhabitants of the deserts of the Old World. The whole of them have narrow upper molar teeth like sheep, and their muzzles are similarly covered with hair. There is very frequently a gland below the eye, and the tail is either short or of moderate length. As a rule, the horns are compressed and lyrate or recurved, or cylindrical and spiral, with distinct rings for a considerable portion of their length. The skull has large pits in the forehead.

The gazelles are among the most elegant of all antelopes, and are characterised by their sandy colour and the presence of a white streak on the side of the face from the base of the horn nearly to the nose, thus cutting off a dark triangular patch in the middle of the forehead, while the streak itself is bordered externally

by a diffused dark line.[1] The horns, which are generally present in both sexes, are lyrate or recurved and are compressed, oval in section, and completely ringed throughout the greater part of their length. The knees are generally furnished with tufts of hair. Glands are present in the feet, and the gland below the eye, if present, is small and covered with hair. Most of the gazelles do not exceed 30 inches in height, although the mohr reaches 36 inches. There are about twenty-one living species belonging to the genus *Gazella*, which are mainly found in the deserts of Asia and North Africa, although the group is represented in South Africa by the springbok. Two of the Asiatic species are found at great elevations. Several species of fossil gazelles occur in the Pleistocene and Pliocene deposits of both Europe and India.

HEAD OF GRANT'S GAZELLE.
(From Sir V. Brooke, *Proc. Zool. Soc.*, 1878.)

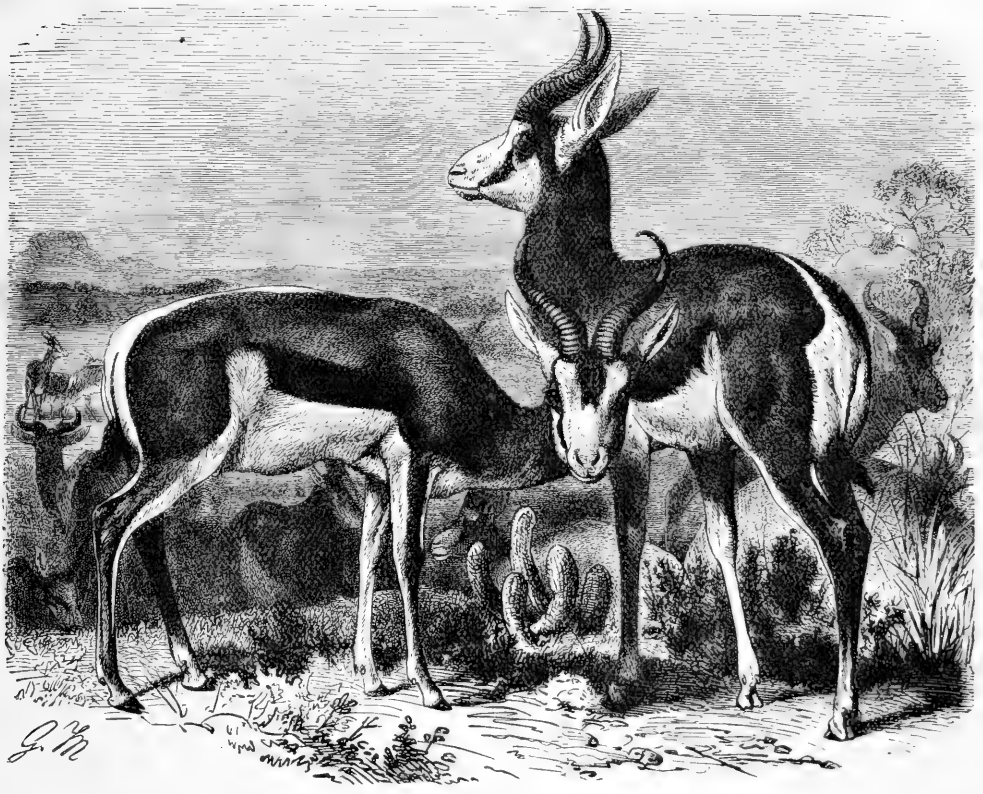
The existing gazelles may be divided into several groups, according to coloration and the presence or absence of horns in the females; and, since the species are so numerous, we shall content ourselves with selecting one from each group for special notice.

Springbok. Our first representative of the genus is the South African springbok (*Gazella euchore*), which differs from all the other species by the presence of a stripe of long white erectile hairs running down the middle of the back, and also by having only two premolar teeth in the lower jaw. Both sexes are horned. In height the springbok stands about 30 inches, and the black horns are lyrate, with about twenty complete rings, and in the males attain a length of from 10 to 15 inches. The general colour is dark cinnamon-yellow, but there is a dark brown stripe on the flanks dividing the cinnamon colour of the sides from the white of the under-parts, and a dark streak running through the eye. The general distribution of the white is shown in our figure, but it may be remarked that there is more white on the face than in any other species, the dark central area of the forehead being reduced to a small patch below the horns. The snow-white hairs on the back have a length of 3 or 4 inches.

In eastern South Africa the northern range of the springbok extends to about latitude 20°, its limits being marked by the forests south of the Mababi River;

[1] These markings are absent in the Tibetan gazelle.

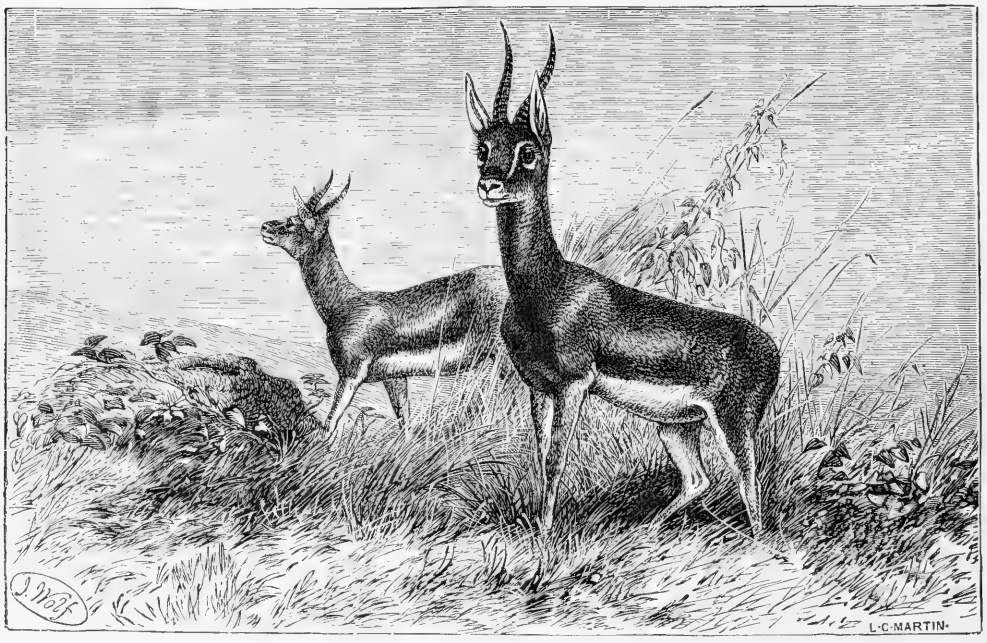
westward of Lake Ngami it extends, however further north, reaching Benguela and Angola on the west coast. According to Mr. Selous, this antelope is still found in the north-west of the Cape Colony, and throughout the Transvaal and Griqualand West; while it is abundant on the borders of the Kalahari desert. The springbok derives its name from its habit of suddenly leaping in the air; and is remarkable both for the vast numbers in which it formerly occurred, and for its periodical migrations. Writing of one of these migrations, Gordon Cumming states that "for about two hours before dawn I had been lying awake in my waggon, listening to the grunting of the buck within 200 yards of me; imagining that some large



THE SPRINGBOK (¼ nat. size).

herd of springboks was feeding beside my camp, but, rising when it was light and looking about me, I beheld the ground to the northward of my camp actually covered with a dense living mass of springboks, marching slowly and steadily along. They extended from an opening in a long range of hills on the west, through which they continued pouring like the flood of some great river, to a ridge about a mile to the north-east, over which they disappeared—the breadth they covered might have been somewhere about half a mile. I stood upon the fore-chest of my waggon for nearly two hours, lost in astonishment at the novel and wonderful scene before me, and had some difficulty in convincing myself that it was a reality which I beheld, and not the wild and exaggerated picture of a hunter's dream. During this

time, these vast legions continued streaming through the neck of the hills in one unbroken phalanx." Later on the same writer continues that, "on our climbing the low range of hills through which the springboks had been pouring, I beheld the plains and even the hillsides which stretched away on every side of me thickly covered, not with herds, but with one vast mass of springboks; as far as the eye could strain, the landscape was alive with them, until they softened down into a dim red mass of living creatures. To endeavour to form any idea of the amount of antelopes which I had that day beheld were vain; but I have no hesitation in saying that some hundreds of thousands were within the compass of my vision." Vast, however, as must have been the numbers on this occasion, the Boers informed the narrator that they were nothing to those that had been witnessed in some



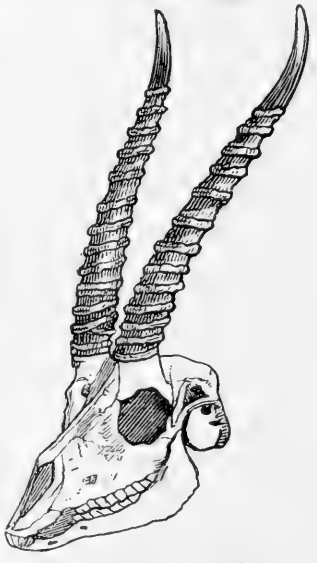
DORCAS GAZELLE.

trekbokken, when the animals extended over a succession of flats, instead of being confined to one alone, and were crowded together like sheep in a fold throughout a long day's journey, as far as the eye can reach. So dense are the moving masses that if a flock of sheep becomes intermingled with the herd they are swept along without hope of escape; and it is said that even the lion may be thus entrapped. Livingstone suggests that these migrations are due to the grass in the Kalahari desert becoming so tall as to impede the springbok from obtaining a clear view of the surrounding country.

Dorcas Gazelle. The Dorcas gazelle (*G. dorcas*), which is figured in our coloured Plate, may be taken as the representative of a group in which the white of the rump does not encroach on the fawn-colour of the haunches, while both sexes have lyrate or sublyrate horns. This well-known species inhabits the deserts of Egypt, Algeria, Syria, Palestine, and parts of Asia Minor. It stands barely

24 inches at the shoulder; and the horns are relatively long and slender, with their tips incurved, their length being sometimes a little over 13 inches. Like most other gazelles, this beautiful little animal is of extremely delicate build, and is remarkable for its great speed. When running, it appears to skim the ground like a bird, and often takes leaps of a yard or more in height. Closely allied to this species is the isabelline gazelle (*G. isabellina*) of Kordofan and Senaar, distinguished by the tail being rufous, instead of black, above. Other species are the korin (*G. rufifrons*) of Senegal; Sundevall's gazelle (*G. lævipes*) of Senaar; and the black-tailed gazelle (*G. tilonura*) of Bogosland; the latter being characterised by its superior size, reaching 29 inches at the shoulder, and the horns varying from 7 to $10\frac{3}{4}$ inches in length.

Indian Gazelle. The Indian gazelle (*G. bennetti*), brings us to a subgroup distinguished from the preceding by the horns not being distinctly lyrate, but generally having a slight S-shaped curvature when seen from the side. The general colour of this well-known species—the ravine-deer of Indian sportsmen—is light chestnut above, while the tail is blackish. In height the buck stands 26 inches at the withers; and the horns, which usually have fifteen or sixteen rings, average 10 to 12 inches in length along the curve. This species inhabits the plains of Central and North-Western India, whence it extends through Baluchistan to Persia. It is commonly found in parties of from two to six, although occasionally from ten to twenty may be found together. Its swiftness is such that it can but seldom be taken with dogs; but it does not leap in the air like the dorcas. Mr. Blanford writes that this gazelle "keeps much to waste ground, especially where that is broken up by ravines, but it is seldom seen on alluvial plains, and it haunts cultivation less than the [Indian] antelope. It is frequently found amongst scattered bushes or thin tree-jungle, and may be met with on undulating ground even on the top of hills; it is commonly found amongst sand-hills, and is nowhere so abundant as in parts of the Indian desert. It lives on grass and the leaves of bushes, and I believe never drinks, for it is common in tracts where there is no water except from deep wells." Other members of this group are the mountain-gazelle (*G. cuvieri*) of Morocco and Algeria, which reaches a height of $27\frac{1}{2}$ inches; the small-horned gazelle (*G. leptoceros*) of the Sudan; the well-known Arabian gazelle (*G. arabica*); and Speke's gazelle (*G. spekei*) of the plateau of Somaliland. The latter species is of very small size, and remarkable for the loose flabby skin of the nose, and is further distinguished by the length of its hair and dull coloration. The length of the horns ranges from $9\frac{1}{2}$ to $11\frac{1}{2}$ inches.



SKULL OF INDIAN GAZELLE.

Persian Gazelle. Another group is formed by three Asiatic gazelles, which differ from all other members of the genus by the females being hornless. Of these, the Persian gazelle (*G. subgutturosa*) inhabits the highlands of Persia and

a large area in Central Asia, extending as far the Gobi Desert. This species has lyrate horns, with incurved tips, which may have from sixteen to twenty-five rings; and the tail is not surrounded by a white disc. The longest pair of horns known measure 14½ inches. In Mongolia, this species is replaced by the larger Mongolian gazelle (*G. gutturosa*), characterised by its extremely pale-coloured horns. The third member of the group is the goa or Tibetan gazelle (*G. picticaudata*), distinguished by the white disc round the tail, the long winter-coat, short ears and tail, the greatly curved horns, and the uniform colour of the face. The height of the animal is 24 inches; and the largest recorded horns measured 15¾ inches in length; the number of rings varying from twenty to thirty. This gazelle inhabits the Tibetan plateau at elevations of from 13,000 to 18,000 feet, and goes in small parties of from two or three to a dozen. It is less shy than other species.

Grant's Gazelle. The last group of the true gazelles is characterised by the white of the rump extending forwards in an angle into the fawn-colour of the haunches; both sexes having horns, which are frequently longer than in the other groups; the animals themselves being also relatively large. Perhaps the handsomest member of the whole genus is the East African Grant's gazelle (*G. granti*), from the Kilima-Njaro district and the neighbourhood of Zanzibar, of which the head is figured in the woodcut on p. 290.

Grant's gazelle has longer and finer horns than any other species of the genus; their length being frequently as much as 26 inches, while in one instance a length of 30 inches has been recorded. The general colour of the upper part of the body is fawn, and there is no dark band on the flanks dividing the fawn-colour from the white of the under-parts. On the neck and back the hair has a kind of wavy appearance, somewhat like the pattern on watered silk. This gazelle is common on the open plains of East Africa, and is generally found in small parties comprising from ten to fifteen does and fawns, accompanied by a single adult buck. Sir J. Willoughby states that in the Kilima-Njaro district these gazelles "were in extraordinary profusion, though extremely wild, and among the herds we noticed many fine bucks. It may be worthy of record that they would often allow us to crawl towards them without showing any sign of alarm, until we were within a fair rifle range; whereas, if we attempted to walk towards them, even in a stooping position, they would invariably start off before we had approached within 400 yards."

HORNS OF THOMSON'S GAZELLE. (From Günther.)

Thomson's Gazelle. In Masailand, on the east coast to the north of Zanzibar, Grant's gazelle is replaced by the allied but smaller Thomson's gazelle (*G. thomsoni*), of which the horns are figured in the woodcut. In this species the horns are relatively smaller and thinner than in the last, not exceeding 15 inches in length. This gazelle is also distinguished from the preceding by the broad dark brown band on the flanks, dividing the fawn-colour of the body from the white of the belly.

Other Species. The largest of all the group is the swift gazelle (*G. mohr*), which is a West African species from Senegal, standing upwards of 32

inches at the withers, and still higher at the rump. Allied to this is the dama gazelle (*G. dama*), from the Sudan, with relatively short lyrate horns, and no dark band on the flanks. Another fine species is the aoul (*G. sœmmerringi*), inhabiting the lowlands of Somaliland, and also found in Abyssinia and the Sudan. In the swift gazelle the length of the horns may be 12 inches; while in the aoul or Sœmmerring's gazelle this varies from about 12 to upwards of 19½ inches. The height of the latter species at the shoulder is about 30 inches. It is characterised by its very massive lyrate horns, marked with about eighteen rings, and may be distinguished from the dama by its longer ears, bordered with black externally, and the more strongly-defined and nearly black markings on the face. This is the finest of the Somaliland gazelles; and was formerly found in small herds close to the shore.

Clarke's Antelope.

Genus *Ammodorcas.*

Nearly allied to the true gazelles is a remarkable antelope (*Ammodorcas clarkei*), recently discovered in Somaliland, which serves to connect the preceding with the following species. Clarke's antelope, while having the facial markings of the gazelles, is distinguished by the regular upward and forward curvature of the rather short horns, which are ringed in front at the base. The females are hornless; and the skull is intermediate between that of the gazelles and the undermentioned gerenuk. The neck is very long, and the tail thin and long. The number of rings on the horn varies from five to ten. The general colour is a deep cinnamon, darker than in any of the true gazelles. These antelopes appear to be local in Somaliland, but are said to be common in parts of the interior. Mr. Clarke states that when running they throw the tail upwards and forwards, and at the same time incline the long neck backwards, so that the two look as if they would touch each other. It is locally known as the dibatag.

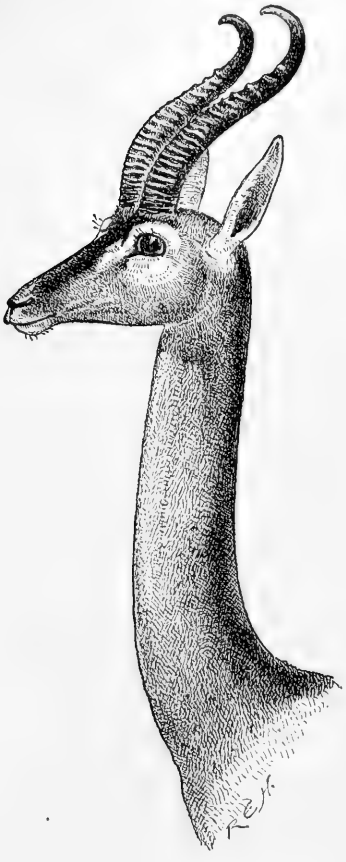
HEAD OF CLARKE'S ANTELOPE.—After Thomas.

The Gerenuk.

Genus *Lithocranius.*

Still more remarkable than the preceding is the gerenuk, or Waller's gazelle (*Lithocranius walleri*), which is also an East African species, ranging from Somaliland to the Kilima-Njaro district. The most peculiar external feature about

this animal is the excessively long neck (as shown in the accompanying figure), which has led to its being likened to a miniature giraffe. The horns of the bucks curve forwards at the tips in a peculiar hook-like manner, and are usually about 13 inches in length, although they may reach 14 inches. The skin of this antelope is distinguished by the presence of a very broad dark-brown band running down the middle of the back, which in its widest part measures some 7 or 8 inches across, and stands out in striking contrast to the rufous fawn of the flanks and limbs.



HEAD AND NECK OF THE GERENUK.
(From Sclater, *Proc. Zool. Soc.*, 1892.)

The skull differs from those of the true gazelles by its extremely dense and solid structure, as well by the relative shortness of its facial portion, its remarkable straightness, and the unusually small size of the cheek-teeth.

Habits. Captain Swayne says that "the gerenuk is found all over the Somali country in small families, never in large herds, and generally in scattered bush, ravines, and rocky ground. I have never seen it in the cedar-forests, nor in the treeless plains. Gerenuk are not necessarily found near water; in fact, generally in stony ground with a sprinkling of thorn-jungle. The gait of this antelope is peculiar. When first seen, a buck gerenuk will generally be standing motionless, head well up, looking at the intruder, and trusting to its invisibility. Then the head dives under the bushes, and the animal goes off at a long, crouching trot, stopping now and again behind some bush to gaze. The trot is awkward-looking, and very like that of a camel; the gerenuk seldom gallops, and its pace is never very fast. In the whole shape of the head and neck, and in the slender lower jaw, there is a marked resemblance between the gerenuk and the dibatag." This antelope subsists more by browsing than by grazing, and it may not unfrequently be observed standing up on its hind-legs, with outstretched neck, and its fore-feet resting against the trunk of a tree, in order to pluck the foliage.

The Chiru, or Tibetan Antelope.

Genus *Pantholops*.

In addition to possessing a peculiar species of gazelle, to which reference has already been made, the elevated and barren plateau of Tibet is further characterised by an antelope remarkable for the swollen nose and long elegant horns of the bucks. This antelope is the chiru (*Pantholops hodgsoni*), the sole representative of the

genus to which it belongs. In many respects the chiru is allied to the saiga, mentioned next, but the nose is less convex, and the nostrils open anteriorly instead of downwards. The horns (which, as in all the following members of this group are present only in the bucks) are black, long, erect, laterally compressed, and sub-lyrate, with rings in front for the lower two-thirds of their length. There is no gland below the eye; and the skull lacks the pits between the eyes found in the other members of the group. In height the male chiru stands 32 inches at the shoulder; and it is covered with very thick, close fur, becoming woolly near the skin. The colour is pale fawn above and white below; the whole face and a stripe down the front of each leg being black or dark brown in the bucks. The horns frequently reach 24 and 26 inches in length, and one pair has been recorded of 27½ inches. The chiru probably inhabits the whole of the Tibetan plateau, at the same elevations as the Tibetan gazelle.

HEAD OF CHIRU.

Habits. In summer the sexes live apart; and these antelopes are often found in parties of from three to four individuals, but sometimes in large herds. They frequent the open rolling plains, or broad river-valleys, and generally feed at morning and evening. Although usually difficult to approach, a solitary buck will sometimes start up from a ravine close to the traveller's feet, as once happened to the present writer. General Kinloch states that the chiru is in the habit of excavating hollows in the sand, in which it will lie concealed during the day. The young are born in summer; one only being produced at a birth.

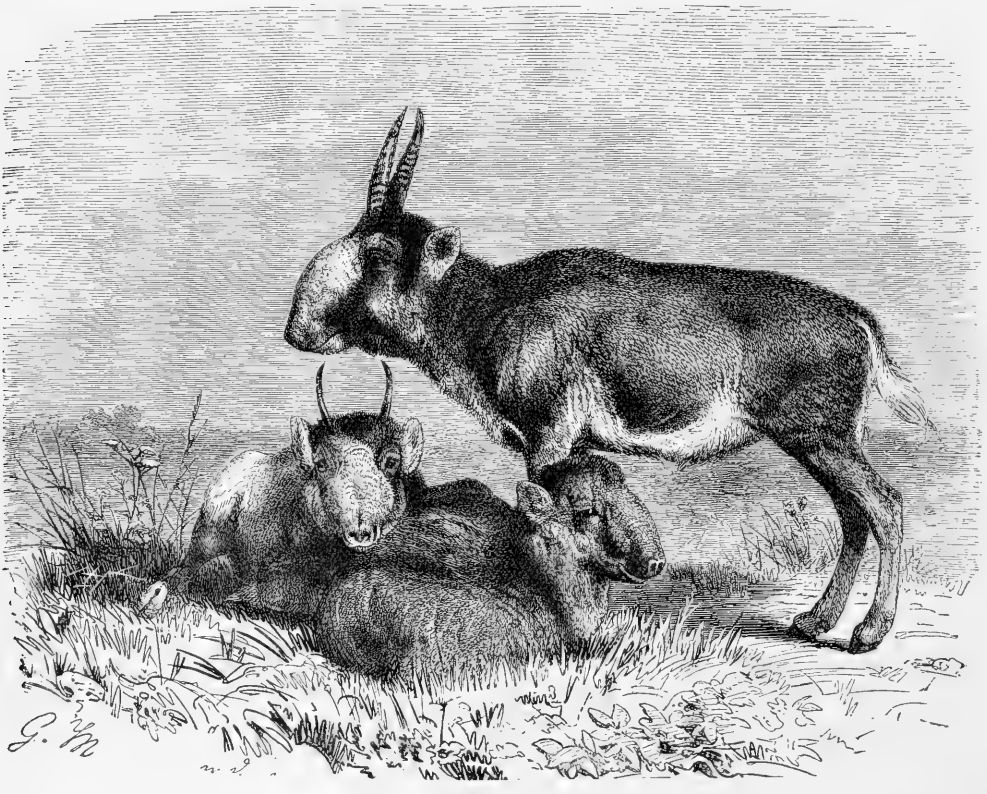
The Saiga.

Genus *Saiga.*

From the peculiarly bloated appearance of the nose of the male, the saiga (*Saiga tartarica*) of the steppes of Eastern Europe and Western Asia is one of the most ungainly of the antelopes, and thereby presents a marked contrast to the gazelles. In size this animal may be compared to a sheep, and its whole build is clumsy. The nose is very large, convex, and inflated, with the nostrils opening

downwards; and the face has a small gland below the eye. The ears are small and rounded; and the tail is of moderate length. The lyrate horns are rather short, completely ringed, and of an amber-yellow colour. In summer the general colour of the upper-parts is tawny yellow; but in winter, when the hair increases in length, the tint is greyish, and, in fact, externally nearly white; the face, under-parts, and the lower surface of the tail are always white. The horns usually attain a length of from 10 to 12 inches along the curve, but may be over 14 inches.

Habits. The saiga is found in large herds, sometimes comprising several hundred individuals during the summer, but these split up into small parties in the winter; the old males always remaining with the herds. According to



THE SAIGA ($\frac{1}{12}$ nat. size).

Pallas, some members of the herd keep watch while the others sleep. Although the saiga, when first started, can run swiftly for a short distance, it soon becomes blown. When caught young, these animals can be easily tamed, and will follow their owners about like a dog.

Distribution. At the present day the range of the saiga embraces Southern Russia and South-Western Siberia; its headquarters being the Kirghiz Steppes. A century ago the saiga extended, however, as far as the confines of Poland; and it is now gradually retreating towards the east of the Volga. In summer the saiga wanders as far north as the districts inhabited by the reindeer; while in winter it migrates south, and thus comes in contact with the Persian

gazelle. When we pass back to the Pleistocene period, the saiga had a much more extensive range to the westward, its fossilised remains having been obtained from the caverns and superficial deposits of Hungary, Belgium, and the south of France. Moreover, from the frontlet of a male having been discovered in the gravels of Twickenham, it is evident that the animal occasionally wandered as far as Britain. In Moravia there have been found the remains of a saiga differing from the living species by having six, in place of five, lower cheek-teeth. From the occurrence of saiga remains, together with those of other mammals now characteristic of the steppes, in Western Europe, it has been inferred that steppe-like conditions and climate must formerly have prevailed over portions of that area.

Palas.

Genus *Æpyceros.*

The South African antelope, known by the name of pala or impala (*Æpyceros melampus*), is a rather large animal, standing a little over 3 feet in height, and of a dark-red colour above, gradually shading into white below. There is no gland on the face below the eye; and the feet are distinguished by the total absence of the lateral hoofs. The horns of the males are lyrate, widely divergent, and somewhat spiral, with about a dozen complete and widely-separated rings. The ordinary length of pala horns does not exceed 16 inches; but Mr. Selous records specimens of 20 and 21 inches, measured in a straight line. The pala is found throughout Southern and South-Eastern Africa. Mr. Selous states that these antelopes are nowhere more plentiful than along the Chobi, and may often be seen in herds of from twenty to one hundred together. "There are very few males in comparison with the number of females, though I have sometimes seen a herd composed entirely of rams, ten or fifteen in number. They are like thick corn along the river's bank, and are seldom seen at a distance of more than a mile from water; and there is no more certain sign of the proximity of water than the presence of impala antelopes." In Nyasaland, Mr. Crawshay states that they frequent sandy plains covered with mimosas and low scrub near the rivers. The same writer observes that "no antelope I have seen can compare with the impala in fleetness of foot, and certainly no other can display such wonderful leaping power; they go off like the proverbial arrow from the bow, and, with most beautiful gliding bounds, cover the ground, without apparently the least effort. When alarmed they often give utterance to a sharp bark." From its red colour, the pala is known to the Dutch Boers as the roybok.

HEAD OF PALA.—After Selous.

Gordon Cumming relates that on one occasion near his camp "a loud rushing noise was heard coming on like a hurricane; this was a large troop of pala pursued by a pack of about twenty wild dogs. They passed our camp in fine style within

a hundred yards of us, and in a few minutes the dogs had fastened upon two of the palas, which my Bechuanas ran up and secured. One of these animals cleared a distance of fifty feet in two successive bounds, and this on unfavourable ground, it being very soft and slippery."

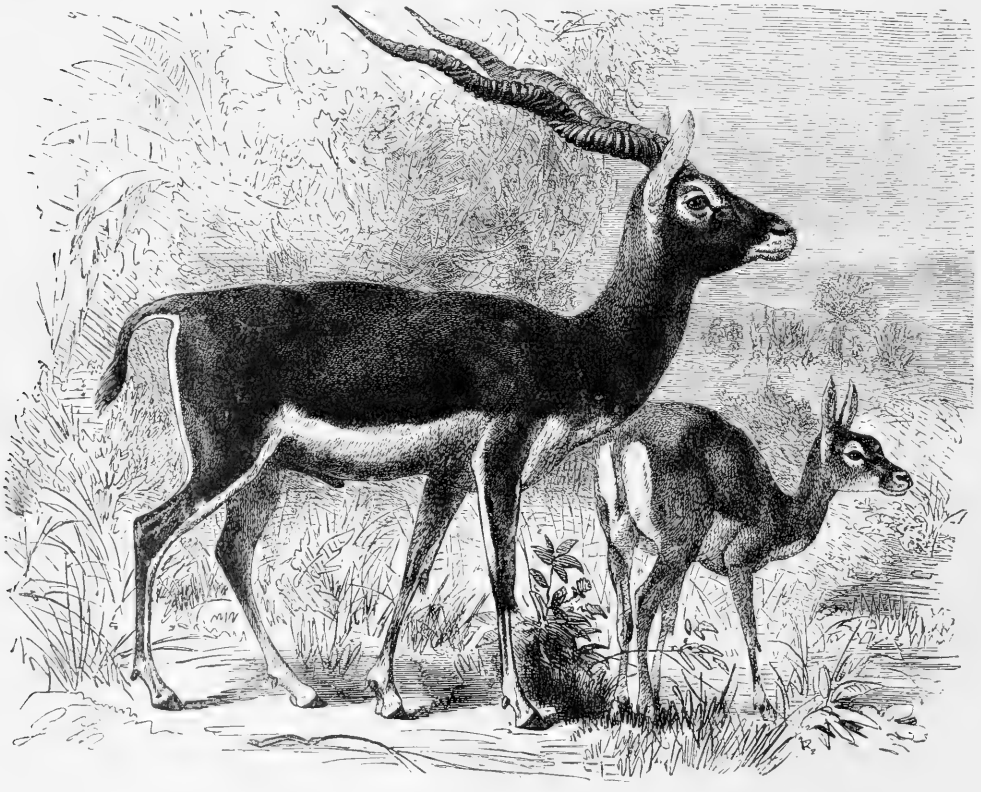
Lesser Pala. The lesser pala is a smaller variety inhabiting part of Nyasaland, in the very heart of the distributional area of the typical form from which it is distinguished by its more slender skull and smaller horns.

Angola Pala. On the west coast, in Angola and Hasholand, the genus is represented by the Angola pala (*Æ. petersi*). This pala is distinguished by the presence of a black streak down the middle of the face, from the eyes to the upper part of the nose, and also by a black patch below each eye.

The Black-Buck.

Genus *Antilope*.

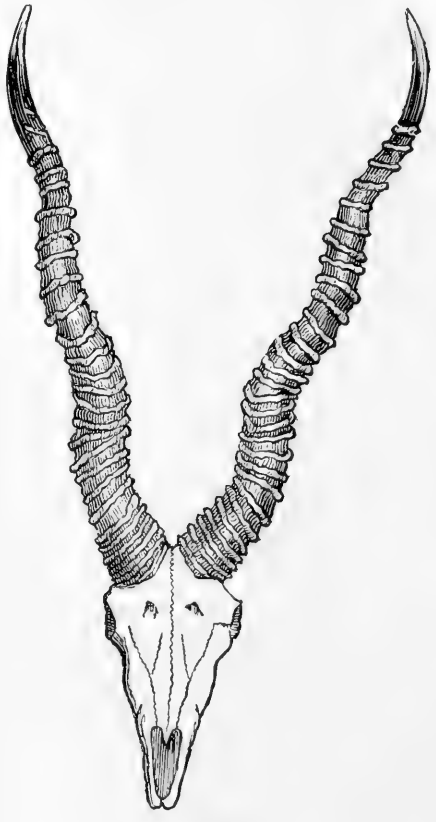
The handsomely-coloured black-buck or Indian antelope (*Antilope cervicapra*) is the sole representative of its genus, and at the same time the last member of the



MALE AND FEMALE OF THE BLACK-BUCK ($\frac{1}{10}$ nat. size).

present group. The black-buck stands about 32 inches at the shoulder, and has a short and compressed tail, large glands, with a linear aperture below the eyes, tufts

of hair on the knees, and small but distinct lateral hoofs. The horns of the bucks rise close together, and are cylindrical, divergent, and spiral, with complete blunt rings throughout their length. The number of turns in the spiral of the horns varies from less than three to as many as five; and there is great individual variation in regard to the degree of divergence of the horns. The usual length of horns varies from 16 to 20 inches in a straight line, and in Peninsular India the length seldom exceeds 22 inches; but in Rajputana and Harriana the horns are longer, and have been known to attain a length of $28\frac{3}{4}$ inches. Does and young bucks are yellowish fawn-colour above and on the outer sides of the limbs, and white on the under-parts; the two colours are sharply defined, and just above the line of division there is a distinct pale streak. Save for a rufous patch on the nape of the neck, the old bucks are blackish brown above, and also on the sides of the neck and the whole of the face, with the exception of a white ring round each eye. In very old individuals the blackish brown becomes almost completely black. Occasionally does are met with having small recurved horns.



SKULL OF BLACK-BUCK.

Habits. The black-buck is an inhabitant of open plains from the foot of the Himalaya nearly to Cape Comorin, and from the Punjab to Lower Assam; and is most abundant in the North-West Provinces, Rajputana, and portions of the Deccan. It frequents either grassy districts or cultivated lands, and is generally found in herds, which may comprise hundreds or even thousands of individuals, but more usually number from ten to thirty, or even fifty does, accompanied by a single old buck. Mr. Blanford states that frequently "two or three younger bucks, coloured like the does, remain with the latter, but these young males are sometimes driven away by older bucks, and form separate herds. This antelope never enters forest nor high grass, and is but rarely seen amongst bushes. When not much pursued or fired at, it will often allow men to come in the open within about one hundred and fifty yards, sometimes nearer." Carts and natives can approach still closer. The black-buck feeds at all hours, although it generally rests during the middle of the day. In certain districts, where there is no fresh water except in deep wells, it is certain that these animals never drink; but several observers have proved that in other places they, at least occasionally, drink freely. Like the springbok, the black-buck frequently leaps high in the air when running. The speed and endurance of these animals are well known; and it is but very seldom that they are pulled down on good

ground by greyhounds. In heavy sand, or on soft ground during the rains, they are, however, easily overtaken by good dogs; and wounded buck may be ridden down. An account of black-buck coursing with the hunting-leopard will be found on p. 445 of the first volume; and antelope-stalking is a favourite Indian sport.

Young fawns are generally concealed by the does in long grass. The bucks utter a short grunt, and the does a kind of hissing sound when alarmed. During the pairing-season the bucks engage in frequent combats among themselves. When taken young, the black-buck can be easily tamed, but the males are apt to be dangerous at certain seasons.

The Reitbok.

Genus *Cervicapra.*

The reitbok, or reedbuck (*Cervicapra arundineum*), introduces us to a totally different group of large or small antelopes confined to Africa. These animals have horns only in the males; narrow, goat-like, upper molar teeth; and either a hairy or a naked muzzle. There is generally a gland below the eye, which may, however, be very small; and the skull usually has a large unossified space below the eye, and distinct pits in the forehead. The horns may be either large, lyrate, widely spreading, and thickly ringed, or small and upright. The tail is either of medium length, or very short.

The reitbok is characterised by its comparatively small horns, which bend forwards somewhat after the manner of those of Clarke's antelope. The tail is bushy and comparatively short, not reaching to within some distance of the hocks, and the lateral hoofs are very small. In height this antelope stands nearly 3 feet; and the short, smooth, and almost woolly fur is of a pale brownish fawn on the upper-parts, with a tinge of orange on the head; the under-parts and inner sides of the limbs being dirty white. Very old does become much paler, in fact almost white. The ordinary length of the horns is from 12 to 13 inches along the curves, although they occasionally reach 15 and 16 inches.

Distribution and Habits. Formerly reitbok were to be met with throughout Central South Africa, wherever there are open grassy or reedy valleys traversed by streams, but they are now practically exterminated in Bechuanaland, and rare in the Transvaal, although still common in many districts, such as the Chobi region, They generally associate in pairs, and it is seldom that more than three or four individuals (of which one or two will be young) are seen together, although sometimes as many as eight may be observed feeding within a short distance of one another. Mr. Selous mentions that "although the reedbuck is never found far from water, it always keeps on dry ground, and when chased I have never seen one take to boggy ground, but have noticed that rather than cross a narrow stream of water they will make a long detour." Indeed, when hunted these antelope will invariably seek refuge in bush, or by flight into the open dry country. The males, if suddenly frightened, sometimes utter a whistling sound. In pace this species is slow, and it is one of the easiest of African antelopes to stalk.

Other Species. The South African antelope known as the roi rhebok (*C. lalandi*), which, by the way, must not be confounded with the true or vaal rhebok, is a smaller but nearly-allied species, standing only about 28 inches at the shoulder. It has long and coarse reddish-brown hair on the upper-parts, while beneath it is white. The horns are seldom more than 8 or 9 inches in length, and bend forwards in a sharp sweep, without any outward inclination. The West African nagor (*C. redunca*) is closely allied to, if not identical with, this species; the coloration being similar, and the small horns not usually exceeding 6 inches in length. The other representative of the genus is the bohor (*C. bohor*), extending in East Africa from Abyssinia to Masailand; it is a larger and brighter-coloured animal than the last, from which it is also distinguished by certain characters of the skull.

Water-Buck, Lichi, etc.

Genus *Cobus*.

The antelopes included in the genus *Cobus* are water-loving animals, generally of larger size than the reitbok, and associating in herds. Their horns are long, sublyrate, and ringed nearly throughout; the tail is longer than the reitbok, and tufted at the end. As in the latter, the gland below the eye is rudimentary; and the colour, with the exception of some patches on the rump and the head is uniform. The muzzle is naked. The skull may be distinguished from that of *Cervicapra* by the premaxillary bones reaching upwards to join the nasals.

HEAD OF WATER-BUCK.—After Selous.

Water-Buck. The water-buck (*C. ellipsiprymnus*) stands upwards of 4 feet or more at the withers, and is characterised by its long and very coarse hair, which varies in colour from reddish brown to dark grey, with an oval ring of white on the buttocks, extending above the tail, a white gorget on the throat, a streak of the same colour on part of each eye, and some white near the muzzle. Good horns average about 28 inches along the curve, but they may measure 30, 31, or even 33½ inches; their colour is pale. Water-buck inhabit Southern and Eastern Africa to some distance north of the Zambesi; and they are never found in herds of more than twenty individuals. Mr. Selous states that the water-buck is most partial to steep stony hills, and is often found at a distance of more than a mile from the nearest river, for which, however, it always makes when pursued. Though a heavy-looking beast, it can clamber with wonderful speed and sureness of foot up and down the steepest hillsides. In Nyasaland Mr. Crawshay writes, that water-buck are always found in greatest numbers on large swampy plains overgrown with coarse grass, tall reeds, and papyrus, where in the wet season it is almost impossible to get at them; unlike other antelopes, except the

reedbuck, they do not appear to leave the lowlands in the rains, but keep to the plains all the year round. The water-buck is less difficult to stalk than the reitbok, but its flesh is so coarse and stringy as to be almost uneatable.

Sing-Sing. The sing-sing (*C. defassa*), from Western and Central Africa, which stands 3 feet 10 inches at the shoulder, differs from the water-buck by its fine and soft hair, and the presence of a continuous whitish patch on the buttocks, which does not rise above the level of the rest of the tail; while there is no white gorget. The horns do not exceed $27\frac{1}{4}$ inches in length, or a fraction over. The sunu (*C. leucotis*), from Uganda, is another large species, distinguished by the blackish colour of its fur, and the white ears, rings round the eyes, and under-parts. The horns are relatively long and thin, reaching from 17 to nearly 20 inches in length.

Other Species. The remaining species are of smaller size, and distinguished by their more reddish or foxy-coloured hair. It is probably to one of these smaller species that the species of *Cobus* found in the Pliocene rocks of Northern India is allied. The West and East African æquitun (*C. cob*) is a much smaller animal than the under-mentioned lichi, and has shorter horns, coming more forwards. It has a relatively shorter tail than the water-buck, and is of a general pale reddish-brown colour, with white on the inner sides of the ears, the under-parts, the inner surfaces of the limbs, the tip of the tail, and a ring round each fetlock. Good horns vary in length from 17 to 18 inches. This is one of the few antelopes that range across Africa, occurring both in Uganda and in Gambia.

THE PUKU.—After Livingstone.

The lichi (*C. leche*) and the puku (*C. vardoni*), are two allied species from South Central Africa, both of which were discovered by Livingstone. The puku is about the size of the pala, standing some 3 feet 3 inches at the shoulder; its hair is of a uniform foxy-red colour, with the tips of the ears black, and black markings down the front of the fore-legs. The horns are rather small, without much forward curvature, and with the rings not extending so high up as in the lichi; their length varying from 13 to 16, and in one instance reaching 19 inches. The puku is a plumply-built animal, with a very erect carriage; and its horns may attain a length of 16 inches along the curve. The lichi is distinguished by its superior size, less erect carriage, and the completely fawn-coloured ears of the adult; the general colour being pale brown,

with the under-parts and rings round the eyes whitish. The horns seldom exceed 24 inches in length, although they have been recorded of 27½ inches. The lichi is strictly a swamp-dwelling animal; and, when undisturbed, can be approached very easily. Mr. Selous states that when these antelopes "first make up their minds to run, they stretch out their noses, the males laying their horns flat along their sides, and trot; but on being pressed they break into a springing gallop, now and then bounding high into the air. Even when in water up to their necks they do not swim, but get along by a succession of bounds, making a tremendous splashing. Of course, when the water becomes too deep for them to bottom they are forced to swim, which they do well and strongly, though not so fast as the natives can paddle; and when the country is flooded, great numbers are driven into deep water and speared." Generally these animals are to be seen standing knee or belly-deep in the water, lazily cropping the aquatic plants; or reposing close to the water's edge. Puku are usually met with in herds of from three to twelve in number, although occasionally as many as fifty may be seen together. They are generally found on dry ground close to the edges of the rivers, but when pursued will take readily to the water. Mr. Selous states that puku and lichi are never found together, although the latter may associate with pala.

The Rhebok.

Genus *Pelea.*

The rhebok, or vaal rhebok (*Pelea capreola*), is the first representative of the second division of the Cervicaprine group, in which the species are mostly of small size, and characterised by their short and nearly upright horns. Of this subgroup the rhebok, which stands about 30 inches at the withers, is the largest species. The horns are placed wide apart over the eyes, and are sharp, slender, and well ringed, rising nearly vertically with a slight forward bend, but with little divergence. Their cross-section is elliptical; and their length from 5½ to 8½ inches. The gland below the eye and the corresponding depression in the skull are wanting. The muzzle is naked; the tail short, broad, fan-like, and bushy; and the hair thick and rather woolly. The colour is a light greyish brown, passing into white beneath.

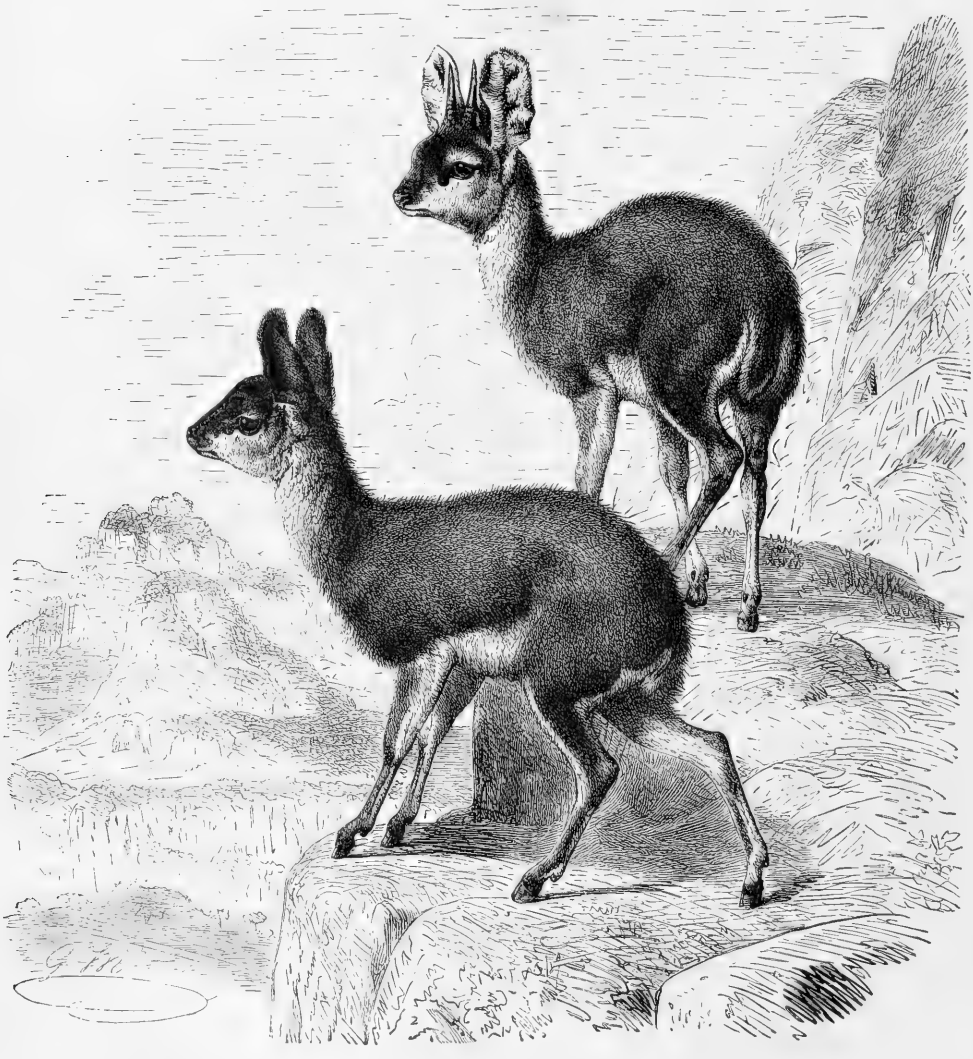
Habits. This antelope is an inhabitant of hilly and mountainous districts in Southern and Eastern Africa; and its habits much resemble those of the chamois. Mr. Drummond states that rhebok "are never found but on the bare hills among rocks and stones, and their habits of springing are wonderful. It seems extraordinary how their delicate limbs escape injury, when they take bound after bound, like an india-rubber ball, in places that a cat would shudder at. I do not suppose that they are really more shy than some of the other antelopes; but the nature of the ground which they inhabit makes it appear so. That it is hard to get at them no one will deny, and it is equally difficult to drive them, unless, indeed, you happen to know the particular troop, have often seen it, and been accustomed to notice the direction they usually take when disturbed." Rhebok only descend from the mountain-tops and ridges at night for the purpose

of drinking. They are usually found in parties of from six or seven to as many as a dozen. From their wary nature, the best way of shooting rhebok is by driving. At the present time, although widely distributed, these antelopes are nowhere abundant.

The Klipspringer.

Genus *Oreotragus*.

Even more active than the rhebok is the diminutive klipspringer (*Oreotragus saltator*), which derives its name—meaning "rock-jumper"—from its unrivalled



MALE AND FEMALE KLIPSPRINGER ($\frac{1}{10}$ nat. size).

power of leaping from crag to crag. This little antelope stands about 22 inches in height, and is characterised by its peculiarly thick and brittle hairs, which are

hollow internally. The colour of the upper-parts is uniform olive. The small straight horns of the male rise vertically from the head and incline slightly forwards at their tips; their length averaging only about 4 inches, so that they are overtopped by the large ears. The hoofs, although somewhat clumsily shaped, are so small that all the four feet could easily stand upon a penny-piece.

Habits. The range of the klipspringer extends from the Cape through Eastern Africa as far north as Abyssinia; and in the latter country these pretty little animals are found as high up as eight or nine thousand feet above the sea. The small size of their hoofs enables the klipspringers to obtain foothold on the smallest projections, and they are consequently enabled to bound up the sides of the steepest cliffs; needless to say, these antelopes are exclusively confined to hilly districts. They were formerly abundant at the Cape, but have now become comparatively scarce. Mr. Crawshay writes that "I have never seen more than a pair together, though in places where they are numerous, one occasionally sees as many as three or four on the move at the same time." The flesh is tender and well-flavoured.

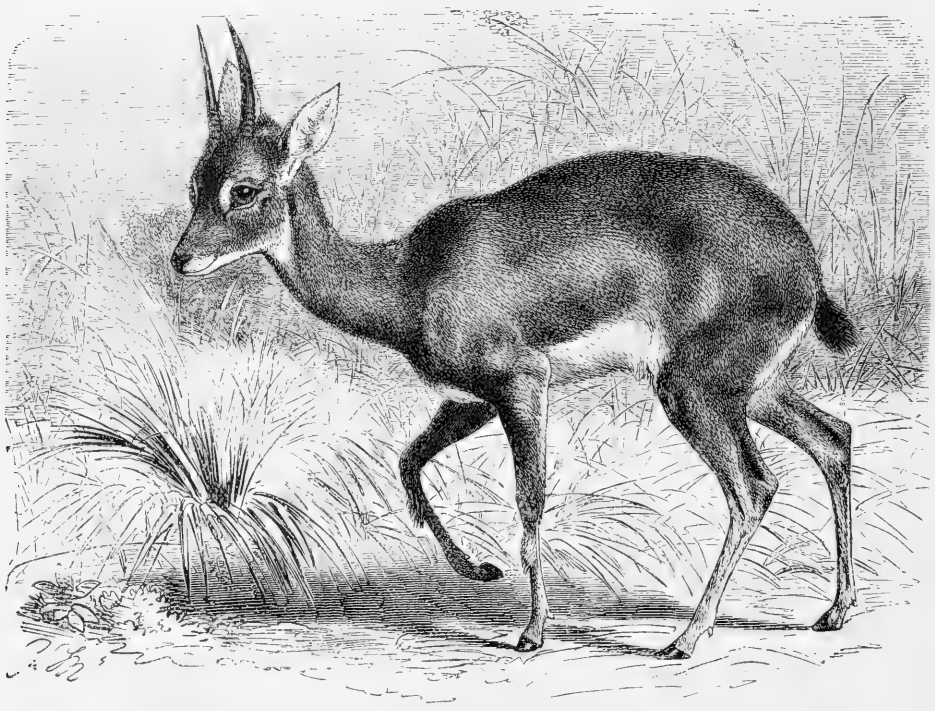
The Steinboks.

Genus *Nanotragus*.

Although the name steinbok is properly restricted to a single species of antelope, it will be found convenient in zoology to apply it to all the members of a small group of these animals forming the genus *Nanotragus*. These pretty antelopes are all of small size, with short horns in the males, no tuft of hair on the crown of the head, a naked muzzle, and a distinct gland below the eye, of which the aperture is circular. The steinboks may be divided into three sections, of which the first is represented by the true steinbok (*N. campestris*). This antelope stands about 23 inches at the shoulder, and is usually of a reddish brown colour, white below; but while in one variety the hue of the fur tends to rufous, in another it is more or less silvery. Together with the other members of the section to which it belongs, the steinbok has neither lateral hoofs nor tufts of hair at the knees. The horns usually attain a length of about 4 inches, but rarely may be 5; and the tail is of moderate length, and of the same colour as the back. This little antelope frequents either open country or thin forest, but avoids mountainous districts, and is common throughout South and East Africa as far north as the Zambesi. Although abundant, these animals are difficult to find, owing to the careful manner in which they conceal themselves. On the east coast this species is replaced by the larger Zanzibar steinbok (*N. moschatus*). The third member of the section is the royal antelope (*N. pygmæus*) of the Guinea coast, which is the smallest of all the Ruminants, standing only 12 inches at the shoulder. It is of a bright chestnut colour, darker on the back than the flanks, with the under-parts glistening white.

Oribi. The oribi (*N. scoparia*), which is the species represented in our figure, differs from the preceding forms by the presence of lateral hoofs, and tufts of hair on the knees. It stands 24 inches in height, and is of a tawny-yellow above and white beneath, the horns being about 5 inches in length.

These antelopes range in South Africa to some distance north of the Zambesi, and are found in parties of two or three on open ground, but are very local. Their colour harmonises closely with the ground, and their speed is very great. The flesh forms excellent venison. There are three other species of this section, among which is the Abyssinian steinbok (*N. montanus*).



THE ORIBI ($\frac{1}{12}$ nat. size).

Grysbok. The grysbok (*N. melanotis*), which is met with only to the north of the Limpopo, differs from the oribi by the absence of the tufts of hair on the knees. It is of about the same size as the steinbok, and of a chocolate-red colour. It is fairly numerous in hilly districts and extends far into the interior.

Salt's Antelope.

Genus *Neotragus*.

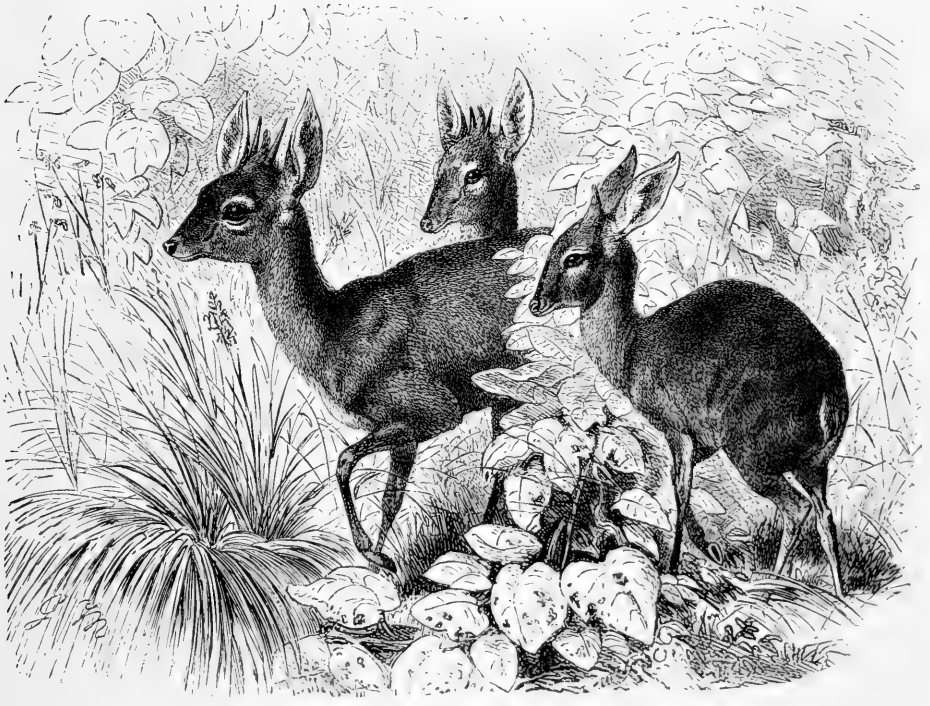
The Beni-Israel or Salt's antelope (*Neotragus saltianus*) of the Red Sea littoral and Abyssinia, which is only slightly larger than the royal antelope, is the best-known representative of a genus distinguished from the preceding by the presence of a tuft of hair on the crown of the head, and by the hairy muzzle, as well as by the horns of the males sloping backwards in the plane of the face. Moreover, the skull is distinguished by the great size of the aperture for the nose and the shortness of the nasal bones, while the last molar tooth in the lower jaw, instead of being composed, as in other Ruminants, of three distinct lobes, has either only two such

lobes, or two with a mere rudiment of the third. The female of the Beni-Israel is only 16 inches in height. In central Somaliland, Kilima-Njaro, and Damaraland this species is replaced by Kirk's antelope (*N. kirki*), differing from the first by having a rudiment of the third lobe in the last lower molar. Kirk's antelope also has a more puffy nose than the Beni-Israel, while its horns are cylindrical instead of being flattened on the inner side. So common is Kirk's antelope in parts of Somaliland, that two or three may be killed at a shot. When disturbed, they start up with great bounds, uttering a shrill cry; the flesh has an unpleasant musky flavour.

Duikerbok.

Genus *Cephalophus.*

The elegant little South African duikerbok brings us to an assemblage of small or medium-sized antelopes, differing in many important respects from the preceding, or Cervicaprine group, which includes all the species from the reitbok to the Beni-



THE DUIKERBOK (⅓ nat. size).

Israel. The name duikerbok properly applies, of course, only to the typical species, but it may be conveniently extended to include the whole group. These antelopes, which are exclusively African, are mainly inhabitants of thick forest, although the typical form frequents brush-covered or open country. They are characterised by their small straight horns, which are generally present in both sexes, being placed far back on the skull and separated by a long tuft of hair. The gland below the

eye is small, and is peculiar in opening either in the form of a slit (as in the species figured) or as a row of small pores. The muzzle has a large naked portion, and the tail is very short. The upper molar teeth have broad and square crowns (as in the figure on p. 158), and thereby differ markedly from those of the preceding group. The majority of the duikers are light and elegantly-built animals, of a more or less uniform colour, and are all very similar in structure. From their generally inhabiting jungly or forest country, they are frequently spoken of as bush-bucks, but since that name is also employed for the guib (p. 277), its use is best avoided.

The common or true duiker (*Cephalophus grimmi*) is found in bush-covered districts from the Cape to the Zambesi and Nyasaland, and on the west coast ranges as far north as Angola. It stands about 26 inches in height, and belongs to a group of three species characterised by the general absence of horns in the female, and by those of the male rising upwards at a sharp angle to the plane of the nose. The ears are very long and narrow, and the colour typically yellowish brown, with a more or less marked grey tinge; but there is great variation in this respect, some skins tending to reddish and others to greenish, while the amount of white on the under-parts is also variable. The length of the horns is usually from 3 to 4 inches, although they may reach 5 inches. The name duiker, it may be mentioned, signifies diver or ducker, in allusion to the rapidity of the creature's movements when in cover. The madoqua (*C. abyssinicus*) is a smaller but allied species from Abyssinia, distinguished by its grizzled greyish brown colour.

Red Buck. The red buck or Natal duiker (*C. natalensis*), which stands about 24 inches at the shoulder, differs by its horns (present in both sexes) inclining backwards in the plane of the nose, as in the majority of the genus. It is also distinguished by its bright reddish-bay colour, shorter and broader ears, smaller horns, and larger head-tuft. Owing to the sudden rushes they make when disturbed, these antelopes are difficult to shoot, and their flesh is unpalatable. There are many other more or less nearly-allied species, such as the philantomba (*C. maxwelli*) of Sierra Leone, to which it will be unnecessary to refer.

Blue Buck. The little South African blue buck or pigmy antelope (*C. monticola*) must, however, claim attention as being the smallest member of the genus. These tiny creatures, which swarm in the Natal jungles, and stand only 13 inches at the shoulder, are smaller and lighter in build than a hare, and are of a bluish mouse-colour, with the tiny straight horns scarcely showing above the tuft of hair. Mr. Drummond states that these antelopes feed principally on certain berries and shrubs found growing in the jungles, and seem to be on the move, more or less, the whole day, though they are most often to be seen at early morning and evening. "Perhaps the most enjoyable way of shooting them is to steal about in the dense jungle, and shoot them as they patter about among the dead leaves which strew the game-paths, or catch them while feeding on some favourite bush."

Zebra-Antelope. Another member of the group is the much larger zebra-antelope (*C. doriæ*) of West Africa, which takes its name from the eight or nine black transverse bands crossing the back and loins, and gradually narrowing to a point on the flanks; the ground-colour being a golden-brown. This coloration is quite unique among Ruminants, and rivals that of the marsupial thylacine.

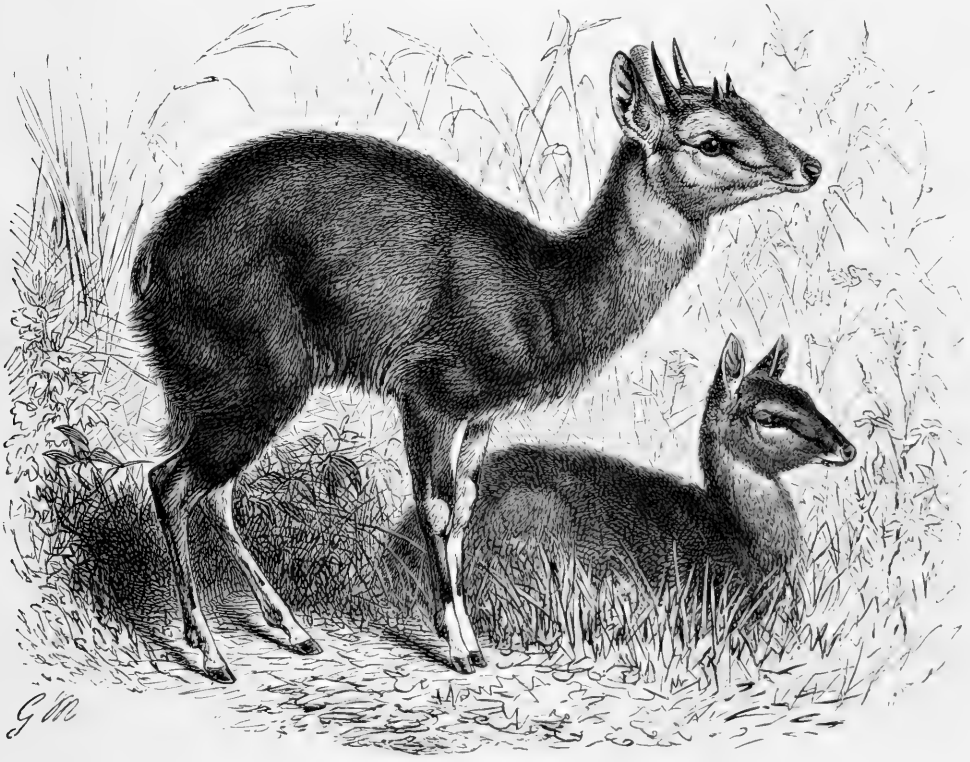
Wood-Antelope.

Two species of this genus from West Africa also call for mention on account of their great superiority in size over its other representatives. One of these is the wood-antelope (*C. sylvicultor*) of Sierra Leone and the Gabun, and the other the black wood-antelope (*C. jentinki*) from Liberia. The former stands about 2 feet $10\frac{1}{2}$ inches in height, and is of a blackish colour, with the hinder part of the middle of the back marked by a yellowish white line. The second species is rather smaller, and is of a greyish colour on the body, with the head and neck black, and the legs, lips, and inner sides of the ears whitish. The tuft of hair on the head is small and inconspicuous. Altogether nineteen species of these antelopes are recognised by Mr. O. Thomas.

Four-Horned Antelope.

Genus *Tetraceros.*

The chousingha, or four-horned antelope (*T. quadricornis*) is the Indian representative of the duikerboks, and differs from all other living Ruminants in



MALE AND FEMALE FOUR-HORNED ANTELOPES ($\frac{1}{15}$ nat. size).

that the male generally has two pairs of horns, of which the larger are placed as in the duikers, while the smaller pair are situated immediately over the eyes. The gland below the eye has nearly the same elongated aperture as in the duikers; but there is no tuft of hair on the crown of the head, and the upper molar teeth

have no additional column on the inner side. All the horns of the male are short, conical, and smooth; the front pair being often reduced to mere knobs, and not unfrequently absent. In height the male chousingha stands 25½ inches at the withers, but an inch and a half higher over the haunches. The fur is thin, harsh, and short, and longer on the upper surface of the tail than elsewhere. The general colour is dull pale brown, with a more or less marked rufous tinge above, passing gradually into white on the under-parts and inner sides and lower portions of the limbs. There is a dark streak down the front of each leg, which is larger in the fore than in the hind pair. The second pair of horns usually vary from 3½ to 4 inches in length, and do not appear to exceed 4½ inches. The front pair are generally not more than 1½ inches in length, but may reach 2½ inches; they are frequently absent in specimens from Madras.

SKULL OF FOUR-HORNED ANTELOPE.

Distribution. The chousingha is found along the foot of the Himalaya from the Punjab to Nipal, and over the greater part of Peninsular India in wooded and hilly country, although it avoids dense jungle. It is unknown in the plain of the Ganges, on the Malabar coast in Madras, and likewise in Ceylon.

Habits. Mr. Blanford writes that the chousingha "differs from all other Indian antelopes in habits as much as in structure. It is not gregarious, very rarely are more than two seen together; it haunts thin forest and bush, and keeps chiefly to undulating or hilly ground. It drinks daily, and is never seen far from water. It is a shy animal, and moves with a peculiar jerky action whether walking or running The rutting season is in the rains, and the young, one or two in number, are born about January or February." General Kinloch writes that these animals "conceal themselves in long grass or among low bushes, and somewhat resemble hares in their habits. They are seldom to be seen out feeding, but usually jump up at the feet of the hunter and bound away at a great pace." Fossil remains of the existing species have been discovered in a cave in Madras; and it is believed that the genus is represented in the Pliocene deposits of the Siwalik Hills at the foot of the Himalaya.

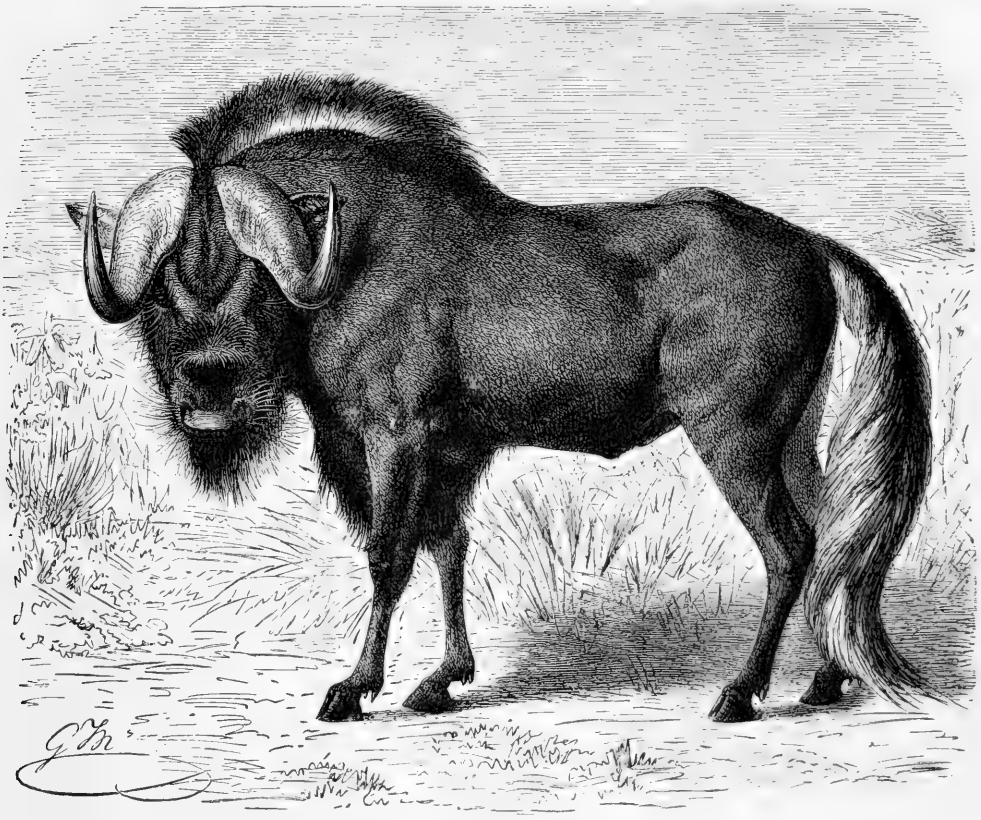
Wildebeests.

Genus *Connochætes*.

The last group of the antelopes is represented by the wildebeests and their allies the hartebeests and blessbok; and is mainly confined to Africa, although one species of hartebeest ranges into Syria. All these antelopes are of large size, and are characterised by the presence of horns in both sexes, as well as by the circumstance that the withers are more or less elevated above the level of the haunches. The muzzle is naked; and there is a small gland below the eye, marked by a tuft of hairs. The tail is long, and the general colour mostly uniform. The horns are more or less lyrate or recurved, and at their origin are placed more or less closely together. Unlike those of other antelopes, the bony cores of the horns are honey-

combed with cavities, as in the oxen; but the upper molar teeth differ entirely from those of the latter animals, having very narrow crowns, without any additional column on the inner side.

The wildebeests, or, as they are often called, gnus, are ungainly-looking creatures, distinguished by their broad and short heads, in which the muzzle is of great width, and fringed with long bristles, so that the nostrils are separated from one another by a considerable interval. The neck is furnished with an erect mane of stiff hairs; and the long tail is thickly haired throughout its length. The nearly smooth, cylindrical horns are situated on the highest point of the skull, and curve

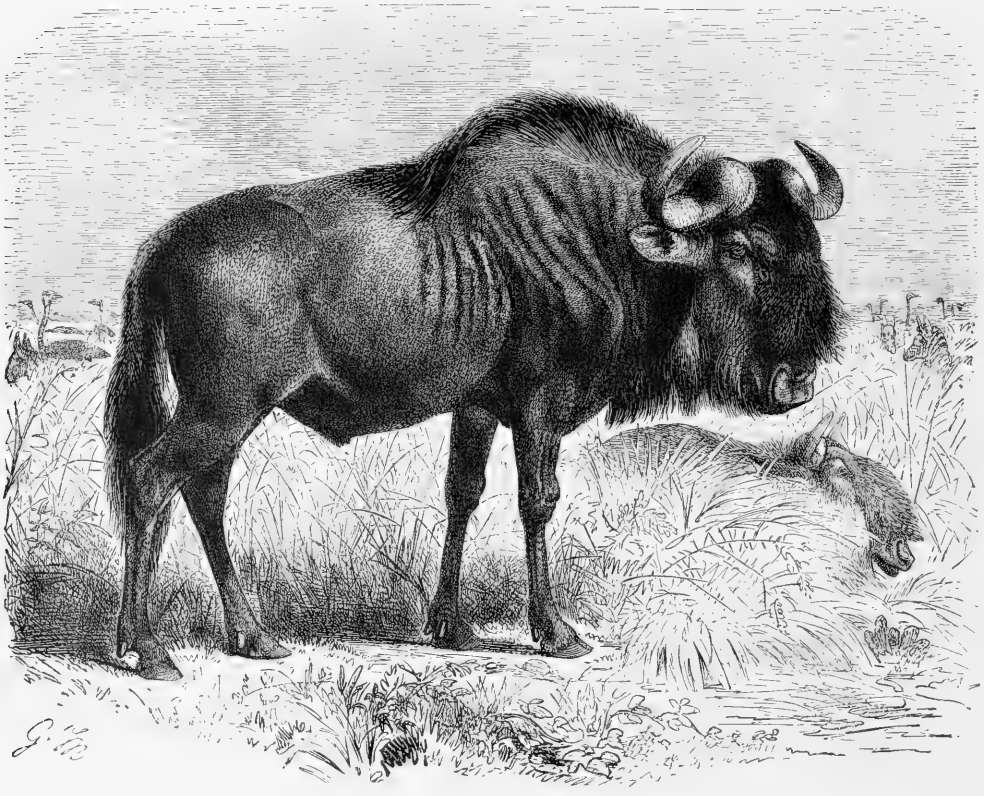


THE WHITE-TAILED WILDEBEEST ($\frac{1}{15}$ nat. size).

outwards, or outwards and downwards, and then bend upwards near the tips. In the young wildebeest the horns are, however, straight and diverging, placed at some distance below the highest point of the skull, and separated from one another by a wide space at the base covered with hair. These straight horns persist as the tips of those of the adult, the curved basal portion of the latter being a subsequent development. In very aged bulls the two horns approximate at their bases, so as to form a helmet-shaped mass completely covering the part of the skull, as in the Cape buffalo.

There are two well-marked species of wildebeest, confined to South and East Africa, both of which are represented in our illustrations. Of these the common,

or white-tailed wildebeest (*Connochætes gnu*), is strictly South African; while the blue, or brindled wildebeest (*C. taurina*), is not found to the south of the Orange River, and on the east side of the continent extends in the Uganda district some distance to the north of the Victoria Nyanza. The former species, which stands about $4\frac{1}{2}$ feet at the shoulder, is distinguished by the long hair fringing the chest, the long white tail, and the uniform coloration of the body. On the other hand, the blue wildebeest has no long hair on the chest, the tail is black and shorter, the sides of the withers are marked with dark transverse stripes, and the hair on the face lies more smoothly. In the ordinary form of this species, the fringe of long

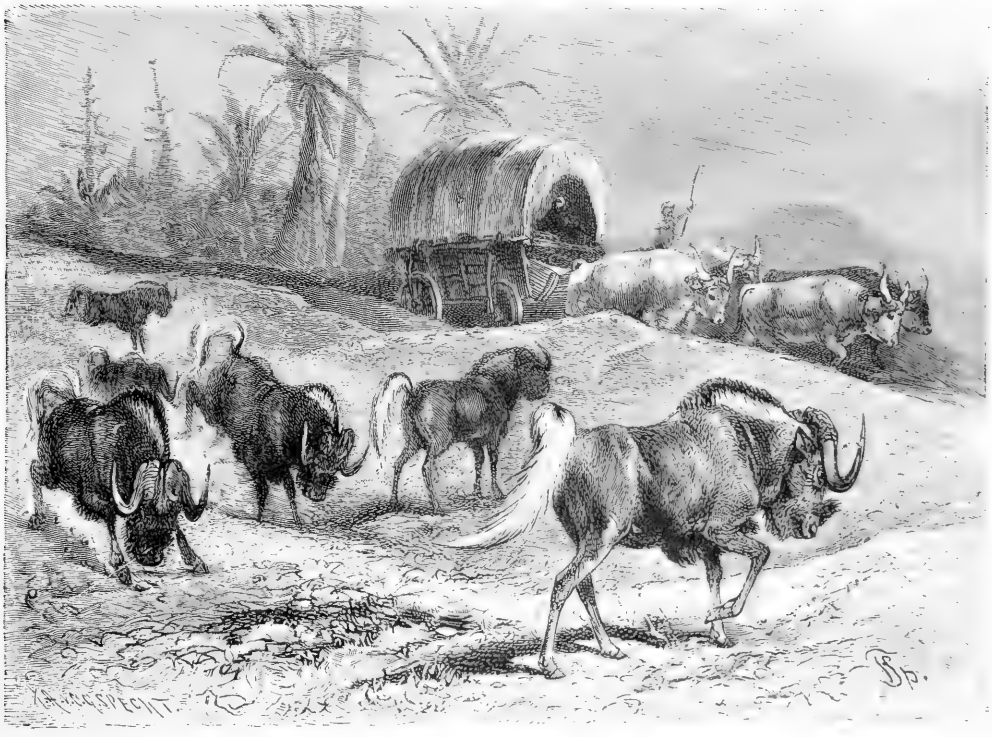


THE BLUE WILDEBEEST ($\frac{1}{20}$ nat. size).

hair on the throat is black; but it is white in a variety from Uganda. The horns of the males of this species have a spread of from 2 feet to 2 feet 2 inches; and in a specimen in which the spread was 2 feet $1\frac{3}{4}$ inches, the greatest length of each horn along the hinder curve was $19\frac{1}{2}$ inches, and the basal girth $13\frac{1}{2}$ inches. Mr. Selous states that the blue wildebeest is met with on the western borders of Griqualand West and the eastern edge of the Kalahari Desert, and from Mashonaland to Lake Ngami in suitable districts. Near Kilima-Njaro it is found in large herds, as is likewise the case in some other districts.

Habits. Wildebeest are found in open country, and never, according to Livingstone, wander far away from the neighbourhood of water. When quagga were abundant, both these animals were frequently found together;

and Mr. Selous states that at the present day a solitary wildebeest may frequently be observed feeding among a herd of sassabi or zebra. Both species of wildebeest are characterised by their speed and endurance. Describing the habits and appearance of the white-tailed species, Gordon Cumming writes as follows:—"The black wildebeests, which also cover the entire length and breadth of the blessbok country, in herds averaging from twenty to fifty, have no regular course, like the blessboks. Unless driven by a large field of hunters, they do not leave their ground, although disturbed. Wheeling about in endless circles, and performing the most extraordinary varieties of intricate evolutions, the shaggy herds of these eccentric and fierce-



WHITE-TAILED WILDEBEESTS CURVETING ROUND A WAGGON.

looking animals caper and gambol round the hunter on every side. While he is riding hard to obtain a shot at a herd in front of him, other herds are charging down wind on his right and left, and, having described a number of circular movements, they take up positions upon the very ground across which he rode only a few minutes before. Singly, and in small troops of four or five individuals, the old bull wildebeests may be seen stationed at intervals throughout the plains, standing motionless during a whole forenoon, coolly watching with a philosophic eye the movements of the other game, uttering a loud snorting noise, and also a short sharp cry which is peculiar to them. When the hunter approaches these old bulls, they commence whisking their long white tails in a most eccentric manner; then, springing into the air, begin prancing and capering, and pursue each other in circles at their utmost speed. Suddenly they all pull up together to over-

haul the intruder, when the bulls will often commence fighting in the most violent manner, dropping on their knees at every shock; then, quickly wheeling about, they kick up their heels, whirl their tails with a fantastic flourish, and scour across the plain enveloped in a cloud of dust." In addition to their speed, wildebeest are remarkable for their extreme tenacity of life; and, owing to the vigorous use they make of their horns, are awkward creatures to hunt with dogs. Mr. Drummond states wildebeest are "so extremely wary that fewer are killed by native hunters than of any other species. Europeans, however, find them good practice in rifle-shooting, as they will stand in herds at a distance which they think secure, say three hundred or four hundred yards, and watch the passer-by." Only occasionally can they be approached within easy range by fair stalking; although they may be killed by watching at their drinking-holes at night. Mr. Drummond writes that, during a thunderstorm of unusual intensity, "I walked, hardly knowing where I was going, right into a herd of gnu. I did not see them until I was almost among them; but even had my gun not been hopelessly soaked, the fearful storm made self-preservation, and not destruction, one's chief thought. They were standing huddled in a mass, their heads together, and their sterns outwards, and they positively only just moved out of my way, much the same as a herd of cattle might have done"

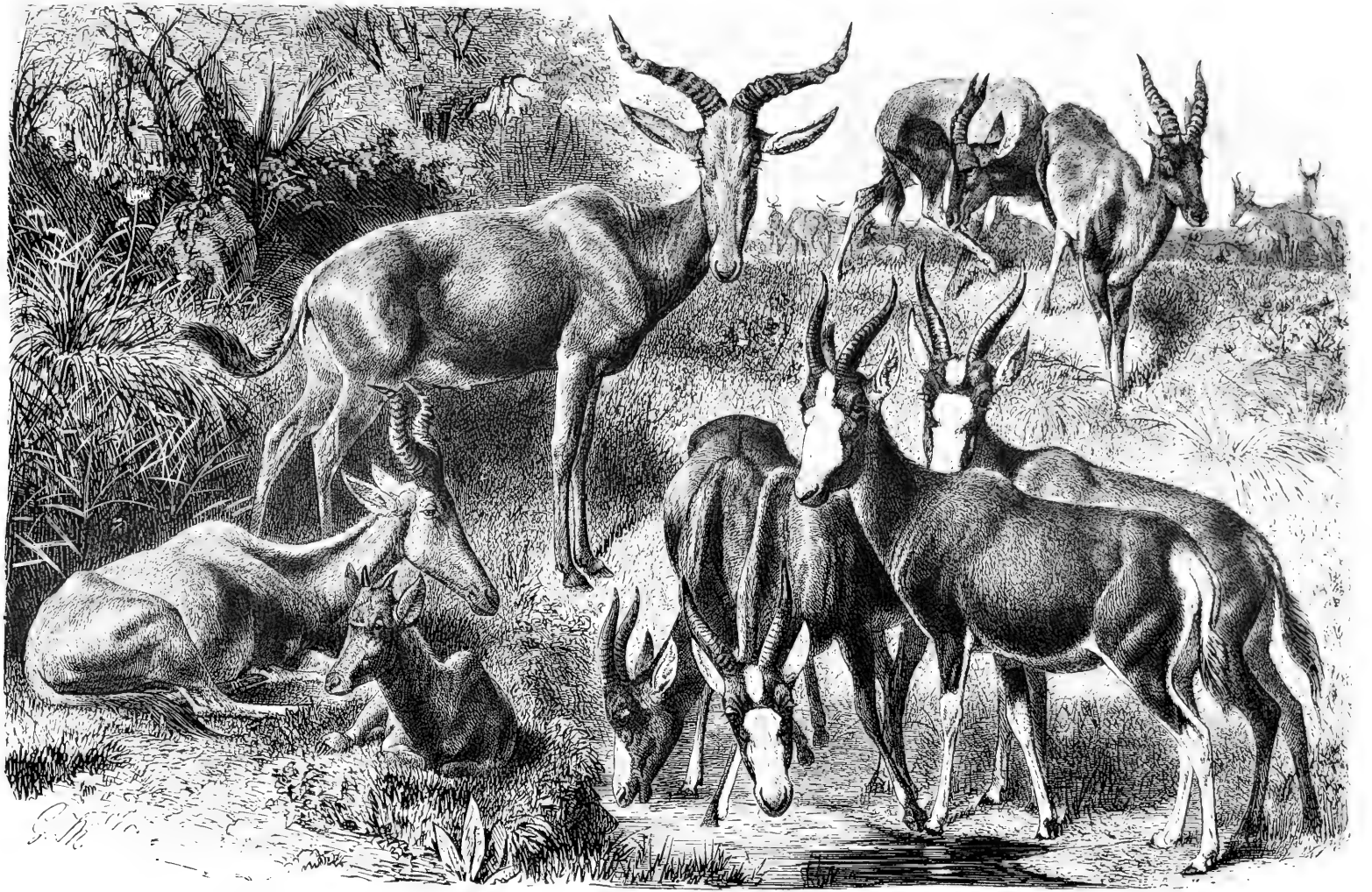
Hartebeests, Blessbok, and Bontebok.

Genus *Bubalis*.

The well-known hartebeest of South Africa (so called on account of a fancied resemblance to a stag) is the type of a genus which may be taken to include several nearly-allied species, and likewise the aberrant blessbok and bontebok.

All these animals differ from wildebeests by their long and pointed heads, terminating in a narrow muzzle; their ringed and often lyrate horns, the absence of a mane on the neck or throat, and their shorter and less thickly-haired tail. In consequence of the narrowness of the muzzle, the nostrils are closely approximated. The horns are compressed, and ringed for a considerable portion of their length; and in form are more or less lyrate, with their tips frequently bent suddenly backwards. In the typical forms the withers are much higher than the haunches, and this feature, together with the great length of the face, communicates an ugly and ungainly appearance to the whole animal. These characters are, however, far less strongly marked in the blessbok and bontebok, and some of the intermediate species. The cows of this genus differ from those of the wildebeests in the presence of only two, in place of four, teats.

Titel. The titel, or bubaline antelope (*Bubalis mauritanica*), of North Africa, Syria, and Arabia, is the only member of the genus not confined to the African continent. It is the smallest representative of the group, standing only 3 feet 7 inches at the shoulder; and is of a uniform bright bay colour throughout. The face is extremely elongated, and the horns are perched on a crest situated on the very summit of the skull. The horns are comparatively short and thick, of a deep black colour, with the rings extending nearly to their tips. They diverge from one another in a U-shaped form; and have their tips



GROUP OF AFRICAN ANTELOPES, VIZ., TORA ANTELOPE; BLESSBOK AND BONTEBOK; AND KORIGUM.

bent suddenly backwards, nearly, but not quite, at a right angle. Their length varies from 13 to 14½ inches.

The Tunisian hartebeest (*B. major*), of west North Africa, is a much larger but closely-allied species, with enormously massive horns, which may be just over 20 inches in length, with a girth of 10¼ inches.

Hartebeest.

The true hartebeest (*B. cama*) is a South African species, not ranging as far north as Matabililand and Mashonaland. This fine

HARTEBEEST (⅛ nat. size).

animal stands about 4 feet at the withers; its general colour being greyish brown, with a pale yellowish patch on each side of the haunches, and black markings on the forehead and nose. The hair of the face is reversed as high up as the eyes, or even to the horns; whereas in the preceding species it is reversed only for a distance of one or two inches above the muzzle. The horns are long, and boldly ringed, diverging from one another in the form of a V, with their tips directed backwards at a right angle, and the bases curved away behind the plane of the forehead. Their length varies in good specimens from 20 to 24 inches.

In the neighbourhood of the Victoria Nyanza the preceding species is re-

placed by Jackson's hartebeest (*B. jacksoni*), distinguished by the uniform pale colour of the face; the hair being reversed for a distance of only about 4 inches above the muzzle. The horns are of about the same dimensions as those of the hartebeest: in the typical specimen their length being $20\frac{3}{4}$ inches along the front curves, with a basal girth of 12 inches; but in a second example the length was $23\frac{1}{2}$ inches.

Habits. Writing of the common hartebeest, Mr. Drummond states that it is one of the fastest antelopes in Africa, and possesses such strength as to render it almost impossible for anything under a whole pack of strong and swift hounds to bring it to bay. "It is common in the great level grass-plains to the north-west of Zululand, and on several occasions I tried coursing them there with two very fast crossed Amaponda greyhounds; but although the latter could run up to them when they had a fair start, they never once succeeded in bringing one to bay, or even in causing one to separate from the herd." In such districts it appears that the only way to obtain a successful shot is for the hunter to conceal himself in a ravine, and have the antelope driven in his direction.

UPPER PART OF SKULL AND HORNS OF COOKE'S HARTEBEEST. (From Günther.)

Cooke's Hartebeest. Cooke's hartebeest (*B. cookei*), of British and German East Africa, brings us to a group of three species, readily distinguished from all the preceding forms by the wide expansion of their horns, as shown in the figure of the skull. The other two members of this group are the tora antelope (*B. tora*), of Upper Nubia and Abyssinia, which is represented on the left side of our illustration on p. 317; and Swayne's hartebeest (*B. swaynei*), of Somaliland, of which the head is shown in the accompanying woodcut and the skull on p. 159. In all these species the hair of the face is reversed only for a distance of 2 inches or less above the muzzle. In Swayne's hartebeest—the sig of the Somalis—the general colour is reddish chestnut, the face being marked by a broad purplish streak extending from a little distance below the eyes. The horns expand very widely, rising at first nearly in the plane of the face, and then forming a right angle with the middle line of the forehead; their smooth tips being bent at right angles to the base, and directed immediately backwards. Their length varies from 15 to $18\frac{1}{4}$ inches. In regard to the habitat of this species, Captain Swayne writes, that to the "south of the highest ranges of Somaliland, and at a distance of about one hundred miles from the coast, are open plains, some four thousand or five thousand feet above sea-level, alternating with broken ground covered with thorn-jungle, with an undergrowth of aloes growing sometimes to a height of six feet. This elevated country, called

the Hand, is waterless for three months, from January to March. Much of it is bush-covered wilderness, or open semi-desert, but some of the higher plains are, at the proper season, in early season, covered as far as the eye can reach with a beautiful carpet of green grass, like English pasture-land. At this time of the year pools of water may be found, as the rainfall is abundant. This kind of open grass-country is called the Ban. Not a bush is to be seen, and some of these plains are thirty or forty miles in extent each way. There is not always much game to be got in the Hand, but a year ago, coming on to ground which had not been visited by Europeans, I found one of these plains covered with herds of hartebeests, there being perhaps a dozen herds in sight at one time, each herd containing three or four hundred individuals. Hundreds of bulls were scattered singly on the outskirts, and in the spaces between the herds, grazing, fighting, or lying down. The scene I describe was at a distance of over a hundred miles from Berbera, and the game has probably been driven far beyond that point by now."

HEAD OF SWAYNE'S HARTEBEEST.—After Rowland Ward.

Cooke's hartebeest is of a reddish brown colour on the upper-parts and greyish brown beneath, the head being dark rufous in front and fulvous on the sides, and thus very different from that of the sig. The horns are also shorter and less widely expanded than in the latter. On the other hand, the tora antelope has the whole face of a uniform pale isabelline tint, like that of the body; the horns being fully as long as in the sig, but rising much more rapidly from the base, then coming farther forwards, and projecting much more in the backward direction. Tora horns vary from 12 to 19½ inches in length.

Konzi. The konzi (*B. lichtensteini*) is a very distinct species, inhabiting all the Zambesi region and Nyasaland, characterised by its small horns, which are much expanded and flattened at their bases. These horns incline at first upwards and outwards, and then inwards, with their tips directed backwards and upwards, so as to enclose a kind of vase-shaped space, their length ranging from 14 to 20 inches. The skull is also shorter than in any of the foregoing species. The general colour is a little lighter than that of the hartebeest; the tail, knees, and the front of the legs being black, while the face is without any dark markings, but the buttocks usually have a pale yellow patch, and the under-parts are likewise yellowish. In Nyasaland this species, according to Mr. Crawshay, is very generally

met with in the hills, if not too steep and rocky, and in the plains, but it appears to prefer a flat or undulating country, well-wooded and with intervening open glades. It is frequently found feeding with water-buck or zebras, and generally goes in small herds of from five or six to fifteen or twenty. Its vitality appears to be nearly equal to that of the water-buck.

Herota.

Perhaps the handsomest representative of the genus is the herota, or Hunter's hartebeest (*B. hunteri*)—from the southern borders of Somaliland, on the great river Tana—which is readily distinguished by the white chevron on the forehead, and the peculiar form of the long horns. This fine antelope stands about 4 feet at the withers, and is of a uniform chestnut-brown colour, with a rather long white tail, and white under-parts. The chevron on the forehead has its angle directed upwards, and terminates in rings surrounding the eyes. The horns, after inclining upwards and outwards for a short distance, run vertically upwards for a much greater length, with long smooth tips. Their length is about 22 inches in the males. The face is still of considerable length, but the hind-quarters do not slope away in the same manner as in the true hartebeest. This antelope is found on the plains and in thick bush on the Tana River. Mr. Hunter says that his party first met with this antelope about one hundred and fifty miles up the Tana River. "It is only found for certain on the north bank of the river. It frequents the grassy plains principally, but is also found in thick bush. It is generally met with in herds of from fifteen to twenty-five individuals. At the time of year when I came across them (October and November) I saw several young ones in the herds. The banks of the Tana River are fringed with a thin belt of forest; then the ground rises slightly, and one sees extensive plains, dotted here and there with large patches of bush, composed principally of euphorbias and aloes. The lesser kudu (see p. 274) lives principally in these patches, and feeds outside of them in the early mornings and evenings. When I first saw the new antelope I was stalking two examples of Waller's gazelle, and though I saw the Hunter's antelope in the distance I mistook them for impalas, which, however, are not found on the Tana on either bank. It was only when I fired at the gazelles and the Hunter's

HEAD OF HUNTER'S HARTEBEEST.
(From Sclater, *Proc. Zool. Soc.*, 1890.)

antelope ran away, that I noticed they were new to me. They ran with rather a heavy gallop, like a hartebeest. We did not come across these antelopes again for some days, but then met with them in large numbers and got several specimens. They seemed to me to have more vitality than any other antelope I ever killed. This species certainly does not extend down to the coast, but we saw them as far as the farthest point we reached (about two hundred and fifty miles) up the river, at a place called Mussa."

Korigum. Ranging across Central Africa, from Senegal on the west to Southern Somaliland on the east, is the korigum or Senegal antelope (*B. senegalensis*), in which the comparatively short horns are regularly lyrate, ringed nearly to their tips, and curving backwards without any distinct angulation. This species is represented in the right upper corner of the illustration on p. 317. The face is only of moderate length, and the withers (as in the sassabi) are not greatly higher than the rump. The face has a broad black band, extending from the root of the horns to the nose.

HEAD OF THE KORIGUM OR SENEGAL ANTELOPE.
(From Sclater, *Proc. Zool. Soc.*, 1890.)

Sassabi. Better known than the last is the nearly-allied sassabi or bastard hartebeest (*B. lunata*), widely distributed in South Africa as far north as the Zambesi. The horns, which seldom exceed 12 inches in length, diverge widely from their bases, and are then inclined inwards and upwards, without any angulation. The general colour of the coarse fur is dark purplish red, becoming almost black along the back, and with a broad blackish mark down the face. In height the animal stands about 3 feet 10 inches, and has horns ranging from 13 to 15½ inches in length. Mr. Selous states that the sassabi "is never found in hilly country or in thick jungle, but frequents the open downs that are quite free from bush, or else open forest-country in which treeless glades are to be met with. On the Mababi flat at the end of the dry season large herds of these animals congregate together, and I have often seen, I am sure, several hundreds of them at once. They are without exception the fleetest and most enduring antelope in South Africa." In regard to sassabi-hunting, Mr. Drummond observes that "I do not consider them a difficult animal to shoot for a good rifle-shot, as standing chances at from one hundred and fifty to two hundred yards are easy to obtain, and they will often allow one to walk up to within that distance in full view before even attempting to take to flight, while,

when wounded, I have found them unable to go far, and easy to finish; and their flesh may be classed with that of the best of the choicer antelopes."

Blessbok. The blessbok (*B. albifrons*) and the closely-allied bontebok (*B. pygargus*), which are represented in the right lower corner of the illustration on p. 317, are smaller South African antelopes, which are the last representatives of the genus. In both species the horns are compressed and regularly lyrate, with the rings strongly marked, and extending nearly to the tips; for a short distance they run almost parallel, and then curve backwards. Their usual length is about 15 inches, but a pair of 18¼ inches is on record. Both species are characterised by their brilliant purple-red colour, and the broad white "blaze" down the face, from which the blessbok takes its name. The bontebok (the animal standing in front of the two on the right side of the illustration) is distinguished by the white blaze on the face continuing without interruption right up to the root of the horns, the white patch on the buttocks surrounding the tail, and the white legs. On the other hand, in the blessbok (shown in the hinder of the two animals standing on the right side of the plate) the blaze on the face is divided by a transverse dark line just above the eyes; there is no white on the rump above the tail, but a dark stripe runs down the outer side of the legs. In height the blessbok stands about 3 feet 2 inches or rather more at the withers, but the bontebok may reach from 3 feet 2 inches to 3 feet 11 inches.

Habits. After mentioning that blessboks resemble the smaller springbok in manners and habits, Gordon Cumming goes on to observe that they differ from the latter "in the determined and invariable way in which they scour the plains, right in the wind's eye, and also in the manner in which they carry their noses close to the ground. Throughout the greater part of the year they are very wary and difficult of approach, but more especially when the does have young ones. At that season, when a herd is disturbed and takes away up the wind, every other herd in view follows it, and the alarm extending for miles and miles down the wind, to endless herds beyond the vision of the hunter, a continued stream of blessboks may often be seen scouring up wind for upwards of an hour, and covering the landscape as far as the eye can see." On one occasion when on the Vet River the same writer states: "On my right and left the plain exhibited one purple mass of graceful blessboks, which extended without a break as far as my eye could strain. The depth of their vast legions covered a breadth of about six hundred yards."

Extinct Species. We may conclude this notice of the hartebeests and their allies by mentioning that a member of the group occurs fossil in the Pliocene strata at the foot of the Himalaya; and it may be inferred from this and the facts above mentioned that the essentially African groups of sable antelope, water-buck, and hartebeests, and probably also kudus, were once represented on the plains of India.

CHAPTER XXII.

UNGULATES,—*continued.*

THE PRONGBUCK, Family *ANTILOCAPRIDÆ;* and

THE GIRAFFE, Family *GIRAFFIDÆ.*

THE prongbuck of North America and the giraffe of Africa differ so much from all other living Ruminants, and likewise from one another, that they are referred by common consent to two distinct families, namely, the *Antilocapridæ* and the *Giraffidæ*. Whereas, however, the former is closely allied to the preceding family of the Oxen, the affinities of the latter are rather with the Deer family, to be described in the next chapter.

THE PRONGBUCK.

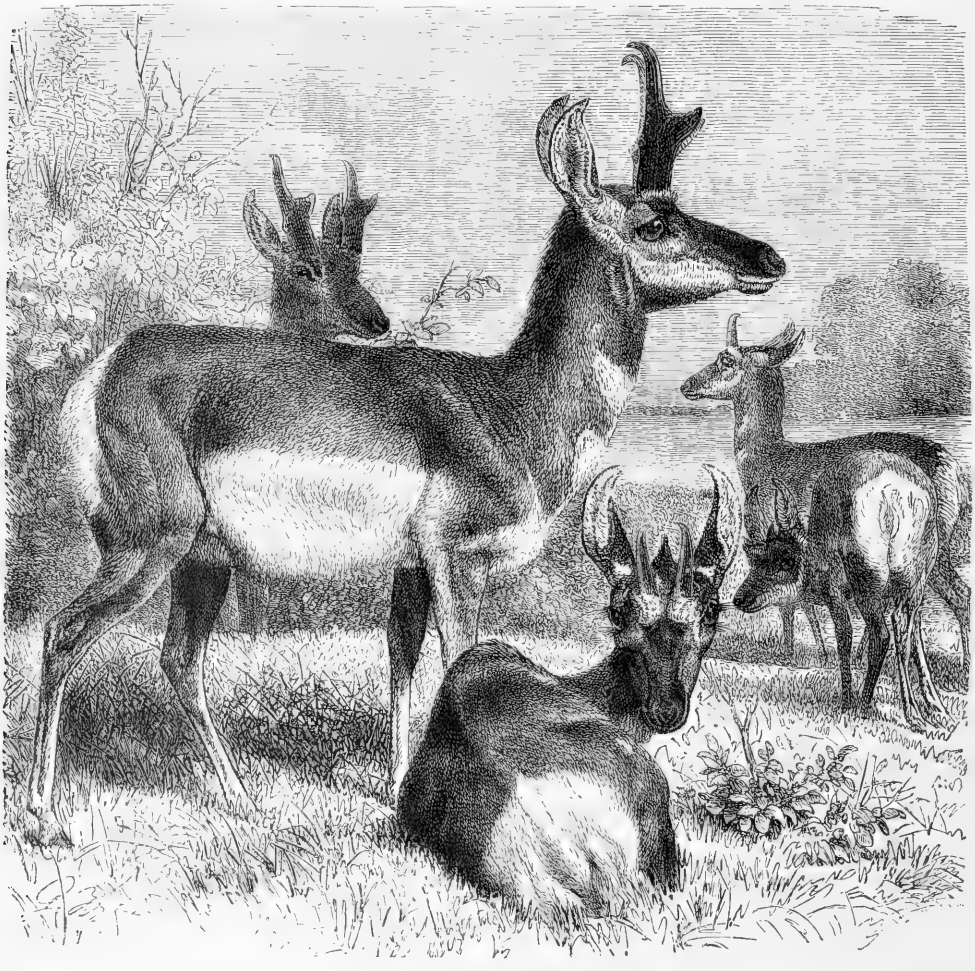
Family *ANTILOCAPRIDÆ.*

The prongbuck or prong-horned antelope (*Antilocapra americana*) much resembles an antelope in general appearance, but differs from all members of the family *Bovidæ* in that the sheaths of the horns give off a short branch about the middle of their length from their front edge, while the sheaths themselves are periodically shed and afterwards replaced by a new growth.

The prongbuck stands about 2 feet 10 inches in height at the shoulder, and some 3 inches more at the rump, and is of a light and graceful build, with the head carried very high. The head is of moderate length, with the muzzle hairy except for a narrow line in the middle of the upper lip, and large and pointed ears. The horns, which are present in both sexes, rise vertically above the eyes; they are much compressed from side to side, and curved slightly backwards at the tips, while the anterior process is inclined upwards and forwards at an angle of about 45 degrees with the main axis. The bony cores of the horns are dagger-shaped, without any branching. The tail is extremely short, not exceeding 3 inches in length, and the feet have small hoofs and no traces of the lateral hoofs so commonly present in the *Bovidæ*. There is no gland on the face below the eye, neither are there any tufts of hair on the knees.

The coloration of the prongbuck is decidedly handsome and striking; the general hair of the upper-parts and outer surfaces of the limbs being chestnut. The hair on the back of the neck, which is of the general chestnut tint, is lengthened into a kind of mane. The face is brownish black; but the summit of the head above the eyes, and likewise the ears, cheeks, and chin are white. White also

prevails on the lower portion of the throat, the under-parts, and the inferior half of the flanks, and extends upwards to form a large patch on the rump which includes the tail. Usually the throat is crossed by three russet-yellow transverse bars, of which the uppermost is continuous with the dark area of the lower jaw. The lower portion of the limbs is white. The horns are black, save at the tips, where they become yellowish; and their usual length is about 12 inches, but Mr. Otho Shaw has a pair measuring 17 inches, with a span of 20 inches.



GROUP OF PRONGBUCK ($\frac{1}{13}$ nat. size).

Distribution. The habitat of the prongbuck appears to be restricted to the temperate regions of the western portion of North America, and there is no evidence that it ever occurred to the eastward of the Mississippi, while it only impinges on that river in its upper reaches. According to Mr. Caton, these animals originally inhabited all the regions, except wooded districts and high mountain ranges, lying to the westward of the Mississippi within the limits of the United States. Up to the year 1855 they were abundant in California, and were not uncommon in the open parts of Oregon; but they have now almost if not com-

pletely disappeared from both these states. In latitude their range extended from the tropics to the 54th parallel; and within these limits they frequent by choice the open prairie country, avoiding thickly-timbered districts or high naked mountains.

Horns. That the horns of the prongbuck were shed annually was long and persistently urged by the hunters of Fort Union; but these statements were received with incredulity by naturalists, who scouted the idea. Eventually, however, it was proved to their satisfaction that the hunters were right and they themselves in error. In fully adult individuals, the annual shedding of the horns usually takes place during October, but in the young the horns are retained till January. In the males the horns can be felt as prominences beneath the skin even at birth, and at about four months old they burst through the skin. They are later in making their appearance in the females, and cannot be detected at birth. One of the best accounts of the shedding and replacement of the horns is given by Mr. Caton, from which the following summary is taken. On looking into the hollow of a shed horn, it will be found that the cavity does not extend much above the point of bifurcation; while it will be also noticed that the interior of the horn contains a number of coarse light-coloured hairs, all of which are firmly attached to its substance, while in the lower part many pass completely through it. The core from which the sheath was cast will also be found to be covered with similar hairs growing from an investing skin; and it will thus be evident that the sheath was more or less completely penetrated by a number of the subjacent hairs, which were of course torn asunder at the time of shedding. Indeed the horn of the prongbuck is in reality nothing more than a mass of agglomerated hairs, and thereby differs markedly from the bovine horn.

On examining the head of a prongbuck from which the horns have been freshly shed, it will be observed that the summits of the cores are already capped with small new horns, which have evidently commenced their growth considerably before the period of casting, as they reach for several inches above the tips of the cores. The summits of these new horns are perfectly hardened, but lower down they gradually become softer and softer, until they pass into the skin investing the greater part of the core. The condition presented by an animal with newly-growing horns is shown in the woodcut on the following page.

It is thus clear that as the new horn gradually increased in length above the summit of the core, it must have loosened and carried with it the old sheath, which eventually became completely detached from the core by the breaking and tearing away of the hairs passing from the skin into its substance. When nearly the whole of the hairs were detached or broken, any sudden motion of the animal would doubtless lead to the loss of the horns; but it does not appear that, at least as a rule, the process is assisted by the animal rubbing its horns against neighbouring objects. In regard to the renovating process, Mr. Caton writes that "when the old horn was cast off, the new one, as we have already seen, had made a considerable growth above the core, which was already tipped with perfected horn, while a section below it was more or less hardened, or partially converted into horn. This intervening section gradually moved down the horn, constantly invading the soft skin below, and followed above with perfected horn. All this time the horn was growing in length above the core, and assuming that posterior curvature near its upper part

which so much resembles the curvature of the horns of the chamois. After the horn is perfected down to the top of the cores, it ceases to increase in length, while the apparently converting process steadily progresses downward along or around the core. The cores being laterally compressed, the horn assumes the same form; not, however, conforming precisely to the shape of the core, but extending considerably in front of it, where it is thinner than the posterior part. At the upper extremity of the wide flattened part the snag or prong is thrown out, which consists of little more than an abrupt termination of the wide part, with an elevated exterior point. By the latter part of winter, in the adult, the horn has attained about this stage of growth. From this it presses on, hardening in its downward growth till the latter part of summer, by which time the growth is perfected down to the base, and is a complete weapon for warfare. In this state it continues until the new horn has commenced its growth and begun to displace the old one from its position, in the manner described above."

HEAD OF PRONGBUCK, WITH NEWLY-GROWING HORNS.
(From Sclater, *Proc. Zool. Soc.*, 1880, p. 540.)

Habits. As regards habits, the prongbuck is a shy and timid creature, avoiding its enemies with great intelligence, although sometimes betrayed into danger by its extreme curiosity. It is swifter than any other native North American Ungulate; but is somewhat short-winded and cannot maintain its speed for any length of time. Prongbucks are essentially gregarious; and, according to Dr. Canfield, individuals of both sexes and of all ages congregate in herds from the beginning of September to the end of February. By the beginning of March, the same writer states, "the does separate themselves from the band one by one to drop their kids. They produce two at a birth. After a little time the does collect together with their young, probably for mutual protection against coyotes; the old bucks in the meantime go off alone, each by himself or at most two together, leaving the young bucks and young does together in small bands. The old bucks now for a month or two wander a great deal, and are seen in the timber-lands, and in other places where they never go at any other season of the year, evidently 'tired

of the world' and fleeing from society. After two or three months, the young bucks and does join the old does and their kids, and finally, by the first of September, all are together once more in bands of hundreds or thousands. Any particular band of antelopes does not leave the locality where they grow up, and never ranges more than a few miles in different directions."

At the present day prongbuck are seldom, however, met with in numbers anything like those just mentioned. During the pairing-season the bucks are combative and frequently engage in fierce contests among themselves. In defence of her young the female prongbuck is said to exhibit great boldness, sometimes even beating off the attacks of the coyote by the vigorous use of both horns and hoofs. Audubon and Backman, in describing the contests between the bucks, state that, "when a male sees another approaching, or accidentally comes upon one of his rivals, both parties run at each other with their heads lowered and their eyes flashing angrily, and while they strike with their horns they wheel and bound with prodigious rapidity, giving and receiving severe wounds; sometimes, like fencers, getting within each others' 'points,' and each hooking his antagonist with the recurved branches of his horns."

In spite of their extreme speed, prongbuck are but poor jumpers, and appear unable to leap over any large object that may be in their path; this incapacity being attributed to the open nature of the country which these animals generally frequent. Mr. Caton states that "this inability to leap over high objects may no doubt be attributable to the fact that they live upon the plains, where they rarely meet with such obstructions, and so they and their ancestors for untold generations have had no occasion to overleap high obstructions, and thus from disuse they do not know how to do it, and never attempt it when they do meet them." The same writer also states that if a prongbuck on the plains desires to cross the railroad track, when alarmed by the cars, as is sometimes the case, he will strain every muscle to outrun the train and cross ahead of it, as if he suspected a purpose to cut him off from crossing; and thus many an exciting race has been witnessed between muscle and steam. When excited during its gambols with its fellows, or by the emotions of rage or fear, the appearance of the prongbuck alters considerably. On such occasions, writes Mr. Caton, "the hair of the white patch on the rump rises up, and assumes a more or less curved radial position from a central point on each side of the vertebræ. From these points the hairs radiate in every direction, only they are as nearly erect as their curved radial position will permit. It is impossible to give a just idea of this appearance by words."

The prongbuck is readily tamed when in captivity; and all who have eaten it bear testimony as to the excellence of its flesh. The brittle nature of the hairs renders the fur of but little value; and it does not appear that the skins are much used as leather. As might be inferred from the nature of its habit, the prongbuck is exclusively a grazing animal; and in captivity avoids browsing on leaves, except when no other food is available.

Hunting. There are two chief methods of hunting the prongbuck; one by stalking or "still-hunting," and the other by coursing with greyhounds. In the north-western portion of its habitat, the proper season for hunting embraces the months of September, October, and November; but in the south-west

the period may be extended to the end of the year. In localities where they have not been much disturbed, prongbuck are comparatively tame and not very difficult to approach within range. The case is, however, very different in districts where they are frequently hunted. Thus Mr. Du Bray writes, that "the ostrich, with his vaunted power of vision, is comparatively near-sighted when compared with the antelope.[1] The giraffe may excel him, not from having superior eyes, but from their greater elevation, and therefore greater scope. The deer is simply nowhere in this respect. Even when in the habit of roaming on the prairie, he has not the knack of detecting an intruder as an antelope has. I never had any trouble in getting within 200 yards of an ostrich, in any decent place; yet, with years of experience on these, and a great deal of other prairie-shooting, I at first found it difficult to get within 600 yards of an antelope, and then it was invariably a wide-awake one, fully able to take care of himself."

For coursing the prongbuck, only the very best bred and toughest greyhounds are of any use, while it is equally essential that the horse on which the hunter is mounted should be of the swiftest. With such dogs it appears, however, that the prongbuck is by no means difficult to pull down, and it may accordingly be inferred that the speed of the animal is considerably inferior to that of the Indian black-buck, which, as we have seen, cannot be captured by greyhounds on good ground.

Extinct Forms. Fossilised remains of the prongbuck occur in some of the superficial Pleistocene deposits of North America, but palæontology has not hitherto revealed to us the existence of any nearly-allied extinct forms. It is suggested, however, that a small deer-like animal (*Cosoryx*), with short antlers, may have given rise to the prongbuck by the loss of the fork in the antlers, and the development of a superficial horny sheath.

The Giraffe.

Family *Giraffidæ*.

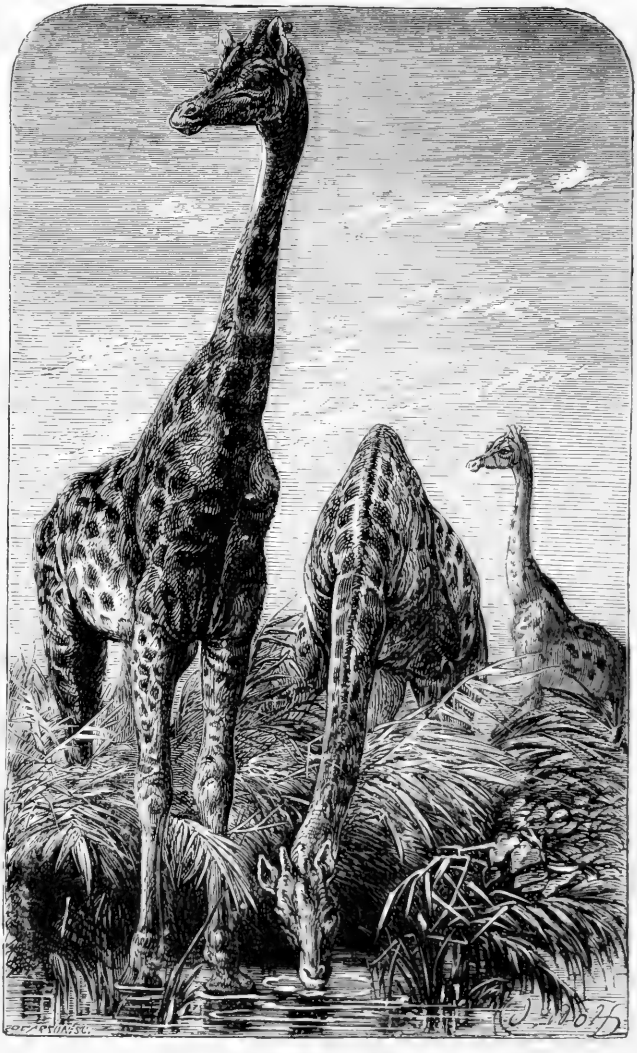
As we have already had occasion to mention, the giraffe (*Giraffa camelopardalis*), like the prongbuck, is the sole existing representative of the family to which it belongs. Whereas, however, the latter animal stands apparently alone among Ruminants, species of giraffes were widely distributed in former epochs, while there were also several more or less closely-allied types now extinct.

Owing to the great length of its neck and limbs, coupled with its large bodily size, the giraffe is by far the tallest of all Mammals. In addition to its elongated neck and limbs, it is characterised by the depth and shortness of the body, the great elevation of the withers as compared with the hind-quarters, and the long and delicately-formed head, with its large, full, and clear eyes, and the pair of horn-like appendages covered with skin which surmount the occiput.

As it is largely owing to the peculiar nature of these horn-like appendages that the giraffe is referred to a distinct family, they require somewhat fuller notice. These horns, as they may be conveniently called, are only a few inches in length, and

[1] In America the prongbuck is often termed the antelope, pure and simple.

are present in both sexes, making their appearance even before birth. They are erect, subconical processes of bone, which at first are entirely separate from the bones of the skull, although in later life completely uniting with them. They are thus essentially different from the horn-cores of the oxen and their allies, from which they are likewise distinguished by being invested with skin instead of horn; while, as we shall see in the next chapter, they are equally distinct from the antlers of the deer. With the exception that they are at first separate bones, instead of part and parcel of the skull, they appear on the whole to come nearest to the horn-cores of the prong-buck, which, as already mentioned, are coated with a hairy skin beneath the deciduous horny sheath. In addition to these paired horns, there is a dome-like bony protuberance occupying the middle line of the skull between the eyes, which is frequently referred to as the third horn. The position and relations of these three appendages of the skull are well indicated in our figure of the giraffe's skeleton.

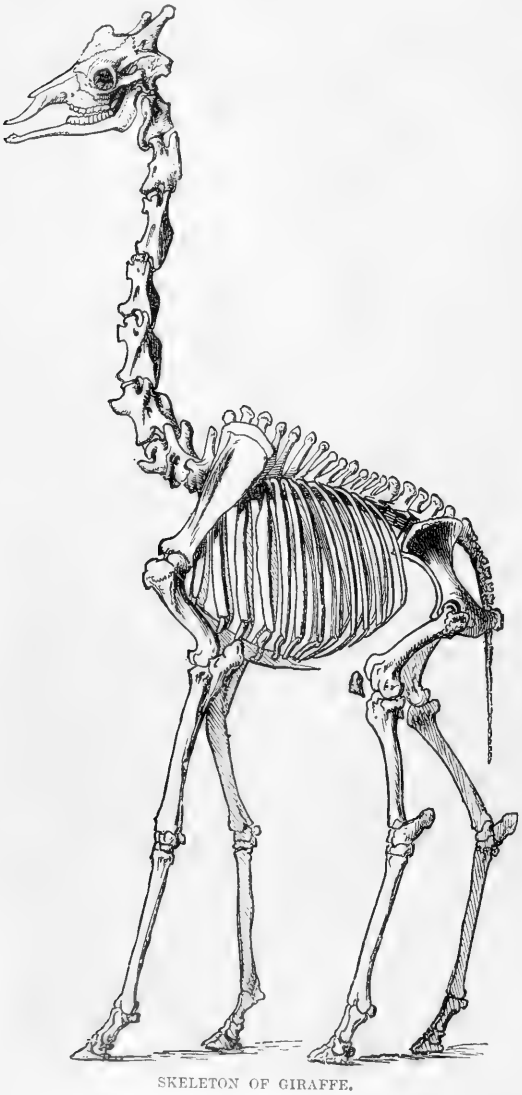


GIRAFFES AT A POOL.

The skull of the giraffe is further characterised by the great elevation of the forehead and face above the level of the eyes, this being due to the development of a number of air-cells in the bones. There is also a large unossified space immediately below the eye. As regards the teeth, those of the upper cheek-series are remarkable for the lowness and breadth of their crowns, and the roughness of the enamel with which they are invested; while there are no canines in the upper jaw.

Reverting to the consideration of the external characteristics of the giraffe, we note that the ears are large and pointed, and that the large and slit-like nostrils can be completely closed at the will of their owner. Moreover, the tongue is

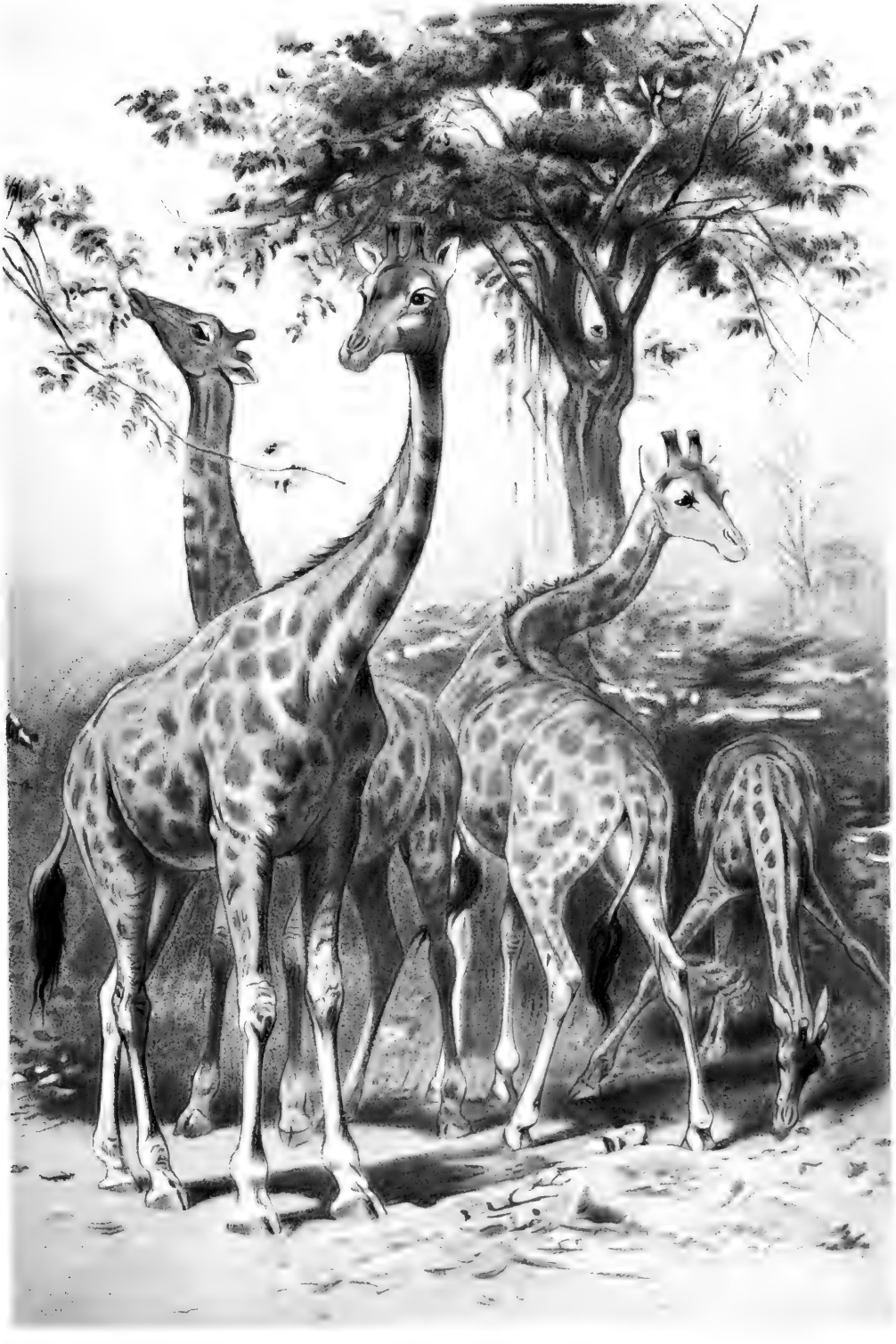
remarkable for its great length, and the distance it can be protruded beyond the lips; thus acting as a grasping organ of considerable power. From the nape of the neck to the withers runs a relatively short and erect mane; and the tail is of considerable length, and terminates in a large tuft of long hair. The feet of the giraffe are large and heavy, and have no trace of lateral hoofs.



SKELETON OF GIRAFFE.

The coloration of the South-African giraffe takes the form of a number of large blotches or patches of some shade of chestnut or brown, irregularly distributed over a paler tawny ground-colour; the face being uniformly brownish, while the under-parts, the inner surfaces of the limbs, and the lower portion of the limbs, are whitish and devoid of darker blotches. The mane is chestnut-coloured, but the tuft at the end of the tail is blackish. It is this variety which is represented in our coloured Plate, and in the woodcut on p. 334. On the other hand, the North-African giraffe may be described as a chestnut-coloured animal, marked by a net-work of fine tawny lines. A full-grown bull giraffe may measure as much as 18 or even 19 feet from the soles of the feet to the summit of the head, while females are a foot or two lower. We must not omit to mention that, as a general rule, the liver of the giraffe is unprovided with a gall-bladder; the animal agreeing in this respect with the deer, and differing from the prongbuck and the hollow-horned Ruminants.

Distribution. The giraffe is confined to Africa south of the Sahara, and was formerly distributed in open districts throughout the greater portion of that continent, although absent from the thickly-wooded regions of the West Coast, its range extending from the Cape in the south to Abyssinia and Nubia in the north. Like the gemsbok and eland, the giraffe frequents more or less desert-like regions; but of late years its range has been greatly restricted, more especially in South and Central Africa, where Mr. Bryden considers that it will be almost exterminated within the next twenty years.



Writing in the year 1881, Mr. Selous states that the giraffe was at that time "still to be found in considerable numbers, over a vast extent of country to the south of the Zambesi River. In parts of the Kalahari Desert it is said to abound, and in all the dry sandy district between Bawangwalo and Lake Ngami, and thence to the Mabebi, Chobi, and Zambesi Rivers, it is also very numerous. Along portions of the Botlebi River, and in the waterless but forest-clad sand-belts on the southern bank of the Chobi, it is particularly plentiful. In the country between the Chobi and the Zambesi, the giraffe is also found in the neighbourhood of Linyanti; but is not nearly so numerous there as on the other side of the former river. Immediately north of the Zambesi it is unknown, although it appears to be plentiful in parts of Central and Eastern Africa. In some parts of the Matabili country it is also common, but till within the last few years was never found eastwards of the river Gwelo (a tributary of the Zambesi north of Matabililand), though it was always very plentiful in the sand-belts to the westward of that river. This fact is the more curious since the soil, vegetation, and general appearance of the country are precisely similar on both sides of the river, which, during a great portion of the year, is only a succession of pools, and therefore does not offer the slightest obstacle to any animal desirous of crossing it. During the last three or four years a few giraffes have extended their range further eastwards."

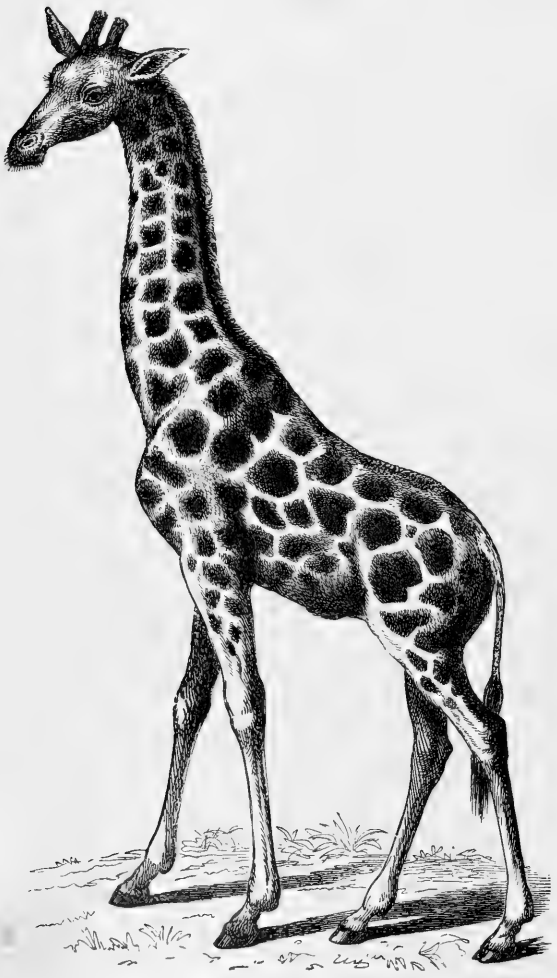
Since the above was written, Mr. Bryden states that giraffes have practically disappeared from large areas to the south of the Zambesi; and their headquarters are now the parched desert country forming the North Kalahari. Probably giraffes are most abundant in the districts lying immediately south of the Botlebi River, on the northern border of the Kalahari Desert. Most of this district is quite waterless for a great portion of the year, and cannot be hunted without water-carts accompanying the party. Here giraffes may frequently be seen in parties of fifteen or twenty, while it is stated that as many as seventy or eighty have been observed together. To the east of the Kalahari, in Khama's country, giraffe are not uncommon; as is also the case in parts of the Chobi Valley; while in Matabililand and Mashonaland they are scarce. Southward of the Limpopo, these animals have been completely exterminated.

The circumstance that the hide of a bull-giraffe now fetches from four to five pounds in the market has been the main cause of the incessant persecution to which these splendid animals have been subjected. It is probable that in Southern Africa they will linger longest in the more inaccessible portions of the Kalahari; while they are likewise likely to persist in the deserts of Kordofan and the Sudan.

Habits. The giraffes inhabiting the North Kalahari Desert cannot, according to Mr. Bryden, touch water for some seven or eight months of the year; and the same is true with regard to those found in other waterless districts. Hence the bushmen state that these animals never drink at all. This, however, is disproved by the following quotation from Mr. Selous, who writes that on a certain occasion he reached camp "a little before sundown, just in time to see three tall, graceful giraffes issue from the forest a little distance beyond, and stalk across the intervening flat, swishing their long tails to and fro, on their way down to the water. It is a curious sight to watch these long-legged animals drinking, and one that I have had several opportunities of enjoying. Though their necks are long,

they are not sufficiently so to enable them to reach the water without straddling their legs wide apart. In doing this, they sometimes place one foot in front, and the other as far back as possible, and then by a series of little jerks widen the distance between the two, until they succeed in getting their mouths down to the water; sometimes they sprawl their legs out sideways in a similar manner." A giraffe in the latter posture is depicted on the right side of the Plate; this position having to be assumed, not only when drinking, but likewise when the animal desires to pick up a leaf from the ground, or on the rare occasions when it grazes.

Writing at a time when giraffes were still abundant in South Africa, Gordon Cumming gives the following graphic account of their habits and appearance. He says that, "in countries unmolested by the intrusive foot of man, the giraffe is found generally in herds varying from twelve to sixteen; but I have not unfrequently met with thirty, and on one occasion I counted forty individuals together; this, however, was a chance, and sixteen may be reckoned as the average number of a herd. These herds are composed of giraffes of various sizes, from the young one of 9 or 10 feet in height to the dark chestnut-coloured old bull of the herd, whose exalted head towers above his companions, generally attaining a height of upwards of 18 feet. The females are of lower stature, and more delicately formed than the males, their height averaging from 16 to 17 feet. Some writers have discovered ugliness and a want of grace in the giraffe, but I consider that he is one of the most strikingly beautiful animals in the creation; and when a herd is seen scattered through a grove of the picturesque parasol-topped acacias which adorn their native plains, and on whose uppermost shoots they are enabled to browse through the colossal height with which nature has so admirably endowed them, he must indeed be slow of conception who fails to discover both grace and dignity in all their movements." Referring to the admirable protective resemblance of many animals to their natural surroundings, the same author goes on to observe that "in



SOUTH AFRICAN GIRAFFE.

the case of the giraffe, which is invariably met with among venerable forests, where innumerable blasted and weather-beaten trunks and stems occur, I have repeatedly been in doubt as to the presence of a troop, until I had recourse to my telescope, and on referring to my savage attendants I have known even their practised eyes deceived, at one time mistaking these dilapidated trunks for camelopards, and again confounding real camelopards with these aged veterans of the forest." It may be added that the dappled hide of the giraffe blends harmoniously with the splashes of light and shade formed by the sun glinting through the foliage of the trees beneath which the animals are wont to take their stand, and thus intensifies the illusion. It will be observed that in the foregoing account the maximum number of individuals observed in a single herd was forty. Larger numbers have, however, been seen together by other observers in Southern Africa, while in the Sudan Sir S. Baker states that on one occasion he counted seventy-three, on another one hundred and three, and on a third upwards of one hundred and fifty-four individuals in a herd.

The food of the giraffe consists almost exclusively of leaves, carefully plucked one by one from the trees by the aid of the long flexible tongue. The senses of both sight and hearing are highly developed; and the lofty position of the head gives to the soft and liquid eyes a wide field of view. The animal's only means of defence is by kicking out with its legs; and the blows thus delivered are of terrific force and power. This mode of attack is employed by the cow in defending her young against Carnivores, and likewise in the contests which take place among the males during the pairing-season.

From observations made on individuals in menageries, it appears that the pairing-time is either during March or in the early part of April, and that the young are born in May or June of the following year; the duration of the period of gestation thus being as much as from four hundred and thirty-one to four hundred and forty-four days, or fourteen and a half months, or a little less. But a single young is produced at a birth, and the little creature in three days after its appearance in the world is able to trot by the side of its dam.

The speed and endurance of giraffes are alike considerable. When running, the tail is carried twisted in a corkscrew-like manner over the back, and the neck inclined somewhat forwards. Their gait is peculiar, and takes the form of a kind of awkward gallop, "their hind-legs," writes Mr. Selous, "being straddled out at each step and coming (one on each side) in front of the fore-legs. If you only look at their bodies and necks from behind, they appear to be sailing or gliding along without making any movement at all. They get over the ground, however, at a great rate, and it requires a good horse to run one down. The great thing is to press them to their utmost speed at first, when, if fat, they soon get blown and can be ridden into, and, if the wind is favourable, driven for miles right up to one's waggons, just like an ox or an eland. At a hard gallop they can, however, spin along for miles."

Hunting. Giraffe-hunting seems to be generally undertaken on horseback, and all who have partaken of it speak of the excitement of galloping behind a line of these magnificent animals scouring across the plains. There are, however, but few who fail to be struck with the pathetic and half-reproachful

expression of a fallen giraffe, and whose hearts are so hardened as not feel some compunction at thus ruthlessly destroying one of the noblest specimens of nature's handiwork.

Mr. Selous expresses his admiration at the sight of a herd of giraffes galloping before the hunter in the following words. On the occasion to which he refers, his horse was not a particularly good one, and the pace consequently not very great. Eventually he got, however, within one hundred yards of his quarry, and he then writes that "even in the ardour of the chase it struck me as a glorious sight to see these huge beasts dashing along in front, clattering over the stones, or bursting a passage through opposing bushes, their long, graceful necks stretched forwards, sometimes bent almost to the earth to avoid horizontal branches, and their bushy black tails twisted up over their backs. And how easily and with what little exertion they seemed to get over the ground, with that long, sweeping stride of theirs! Yet they were going at a great rate, for I felt that my old nag was doing his best, and I could not lessen the distance between us by an inch."

All who have eaten of it, testify to the excellence of the flesh of the giraffe; and we have already made mention of the value attached to its hide.

Captivity. The giraffe thrives well in captivity, where it breeds readily. On the morning of May 24th, 1836, those Londoners who happened to be passing along what was then called the New Road, were startled by the appearance of four giraffes, with their Nubian attendants, on their way from the docks to the Zoological Society's Gardens in the Regent's Park. Of these four individuals three were males and one a female; and they respectively lived till the years 1837, 1846, 1849, and 1852. Between 1836 and 1892 the Zoological Society had upwards of thirty giraffes in their menagerie, no less than seventeen of which were bred and born there. One of the latter which was born in the spring of 1846 lived till January 1867, or close upon twenty-one years. The last of this series of giraffes died in March 1892, and owing to the inaccessible condition of the Sudan at the present time, it has hitherto been found impossible to replace its loss.

Extinct Giraffes. Fossil giraffes are found in the Pliocene rocks of Greece, Persia, the Siwalik Hills at the foot of the Himalaya, and China. All these extinct forms appear to have been closely allied to the living African species, although in some instances the length of the limbs seems to have been proportionately somewhat less.

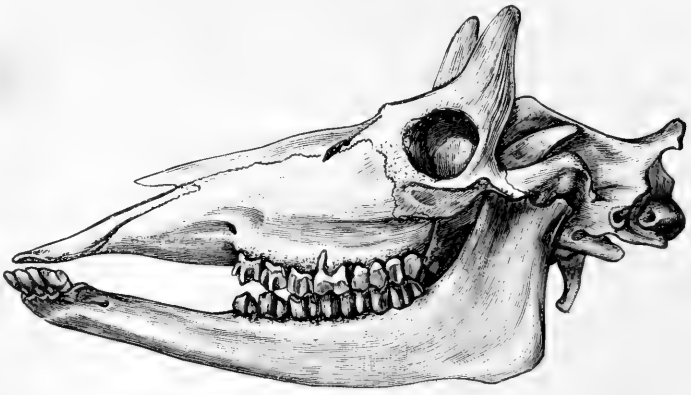
Extinct Mammals allied to the Giraffe.

In addition to the fossil giraffes just mentioned, there are other extinct Mammals from the Pliocene formations of Europe and Asia which, while evidently referable to the same group of Ruminants, must be assigned to distinct genera.

One of the most giraffe-like of these creatures is the helladothere of Greece, a hornless animal, of larger dimensions than the giraffe, but with a shorter neck and limbs. The limbs agree, however, with those of the latter in the great proportionate length of the front pair, and the skull has a considerable general resemblance, although with a smaller development of cells in the bones of the forehead, and

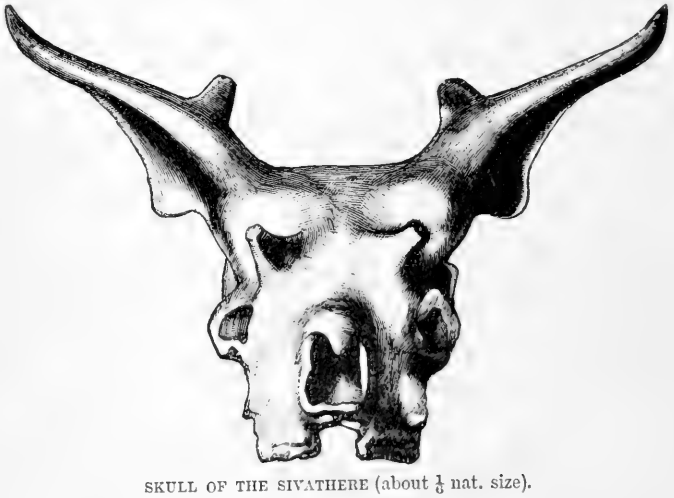
without an unossified space in front of the eye. An allied animal, known as the libythere, has left its remains in the Pliocene strata of Algeria.

In the samothere of the Isle of Samos and Persia, of which the skull is shown in the accompanying woodcut, the fore and hind-limbs are of nearly equal length, and the forehead, owing to the absence of cells, is nearly flat, while there is no unossified space in front of the eye. The eyes were surmounted by a pair of flattened bony processes, which there is some reason to believe were detached from the bones of the forehead in the young state, and which may have been clothed either with skin or with horny sheaths in the living condition. In many respects the skull of this animal approximates to that of the elk.



SKULL OF THE SAMOTHERE (about $\frac{1}{6}$ nat. size).

By far the largest of all Ruminants was the gigantic Indian sivathere, whose skull and limb-bones rival in magnitude those of the biggest rhinoceroses. The skull of this enormous creature was very short and wide, and, in the male at any rate, carried a pair of large antler-like appendages, situated immediately over the occiput, in addition to which there was a pair of simple spike-like horns above the eyes. Although the branched appendages of the skull recall the antlers of the elk, it is evident that they were never shed: and it is, therefore, probable that they were covered during life either with hairy skin or with horn. In any case, they were to a considerable extent intermediate in their nature between the horns of the oxen and the antlers of the deer. Other kindred types were the hydaspithere and the bramathere of India, in both of which the appendages of the skull take origin from an elevated common base rising above the forehead. In the former of these animals there was a large unossified space in front of the eye, similar to that occurring in the giraffe and the deer.



SKULL OF THE SIVATHERE (about $\frac{1}{6}$ nat. size).

CHAPTER XXIII.

UNGULATES,—*continued.*

THE DEER-TRIBE.

Family *CERVIDÆ.*

THE last representatives of the true Ruminants, or, as they are technically called, *Pecora*, include the typical deer, the elk, the reindeer, the musk-deer, etc. The

SKELETON OF MALE RED DEER.

great and distinctive feature of this group is the general presence in the male sex of the peculiar branched appendages on the skull, which are now generally known

by the name of antlers. Unfortunately, so far as simplicity of classification is concerned, these appendages are not present in all the members of the family, and the zoologist has, therefore, to rely partly on other characters in defining the group. Still, however, as these antlers are the most characteristic features of the deer-tribe as a whole, their importance cannot be overrated, and we accordingly take them first into consideration.

Antlers. With regard to the meaning of the term antler, it appears that the word is derived from the old French *antoiller*,—a corruption of the late Latin *antoculorum* (before the eyes),—which was originally applied to that branch of the antler which descends over the forehead, and is now designated the brow-tine. At a subsequent period the word antler seems to have been employed indifferently for all the branches of these appendages, while still later it was used to designate the entire appendages themselves. It is in the latter sense that it is now employed, the various branches of the antlers being termed tines.

In addition to being generally more or less branched, the most characteristic feature of an antler when fully developed is that its outer surface is rugged and devoid of any covering of skin or horn. In fact, for all practical purposes, an antler may be regarded as a mass of dead bone borne for a certain period by a living animal. Except occasionally, as an individual peculiarity, antlers are shed once every year, and, save in the reindeer, are present only in the male sex. They arise from a pair of longer or shorter bony pedicles situated on the skull above and behind the eyes, and forming part of the skull itself.

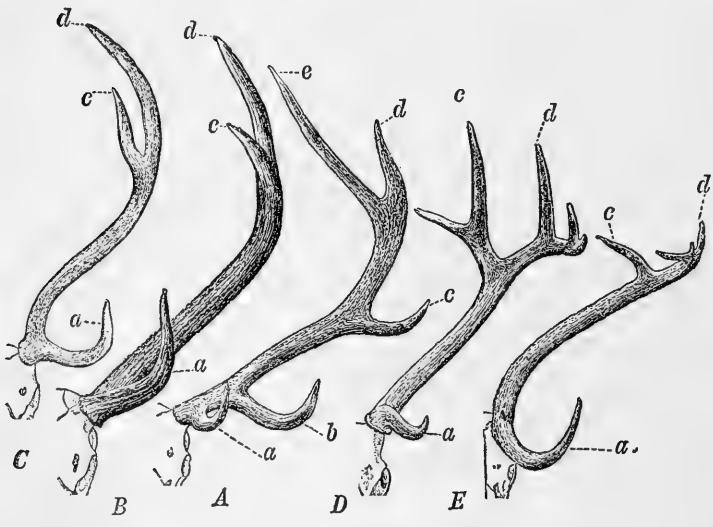
HEAD OF RED DEER WITH NEW ANTLERS IN THE "VELVET.

When the antlers of a stag have been recently shed the above-mentioned bony pedicles are completely covered with skin, and merely form small prominences upon the upper part of the forehead. In a short time, however, there appear on the summits of these pedicles small velvety knobs, which are highly sensitive and tender, and are supplied by an unusual number of blood-vessels. These knobs are formed by a deposition of bony matter, and increase very rapidly in size. In young deer and a few of the smaller forms their growth is limited to the formation of a simple spike, or a spike with one fork, but in the adults of the more typical kinds of deer they branch into a smaller or larger number of tines, until they finally assume the form of the complete antler. The

whole antler is then completely invested with a soft and vascular skin clothed with exceedingly fine hair, hence termed the "velvet." When, however, the growth of the antler is completed in its upper part, a deposition of bony matter takes place at its base, just above the point of union with the pedicle of the skull, in the form of a prominent ring. This ring, of course, constricts the blood-vessels supplying the velvet, and ultimately causes them to dry up. In consequence of this cutting off of the supply of blood by the ring or "burr," the velvet itself likewise dries up, and is eventually removed by the animal rubbing its newly-formed antlers against the stems of trees or other convenient objects. The antlers are then complete. They attain their full development shortly before the commencement of the pairing-season, and during that period they are employed as most efficient weapons in the contests which then take place between the males of all the species of the deer-tribe. Subsequently the living bone beneath the skin below the burr of the antlers is absorbed, when the antler itself is shed, to be renewed in the following season in the same manner as before.

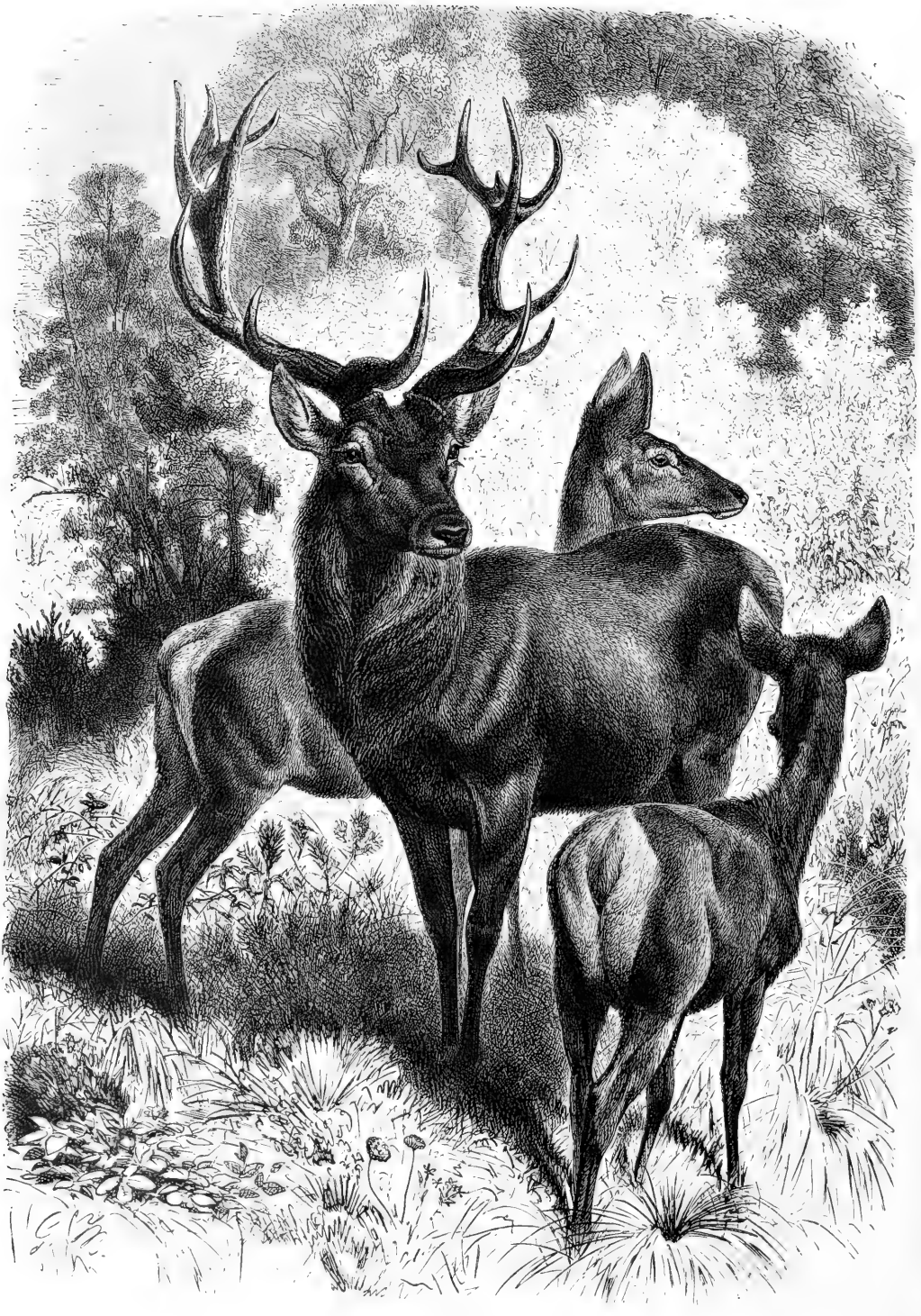
In the fawns the antler takes the form merely of a simple conical spike, and this type is retained in certain South American species throughout life. In the following year the antler gives off a branch near the base, and this form also constitutes the highest development attained by some of the smaller species. In the more typical deer the antlers, however, become more and more branched with each succeeding year, till in the red deer they may occasionally have as many as forty points. The amount of bony matter annually secreted to form the antlers of the larger deer is enormous, antlers of the red deer having been obtained which weighed upwards of 74 lbs., while those of the extinct Irish deer must have probably scaled 100 lbs. during life.

The different tines borne by the antlers of the red deer and other allied species have received distinct names, and, as it is of the highest importance that these should be clearly understood, they may be referred to at once. In the red deer group (*A* of the accompanying figure) the shaft or beam of each antler carries three tines on its lower front edge, of which the lowest (*a*) is termed the brow-tine, the second (*b*) the bez-tine, and the third (*c*) the trez-tine, or sometimes the royal tine. The summit of



LEFT ANTLERS OF ASIATIC DEER.

A. Hangul, or Kashmir deer; *B*. sambar; *C*. spotted deer; *D*. swamp-deer; *E*. Eld's deer; *a*, brow-tine; *b*, bez-tine; *c*, trez-tine; *d*, *e*, anterior and posterior surroyals.—After Blanford and Forsyth.



A FAMILY OF RED DEER.

the beam may either be divided into two or three tines (as in the figure on p. 340), or may be split up into an almost indefinite number of snags, radiating outwards from a kind of cup; but in any case these terminal snags, irrespective of their number, are collectively spoken of as the surroyals, or the crown of the antler. It will be seen from the figure that in many deer the bez-tine of the antler is wanting; but of this and other variations in form more will be said later on.

Other Characters. Having thus noticed that the deer are more satisfactorily distinguished by the presence of antlers in the males, we have now to mention certain characters which will aid in distinguishing from other Ruminants those members of the family in which the antlers are wanting. In the first place, all deer have a very large unossified space in the skull in advance of the orbit, this space being so extensive as to prevent the lachrymal bone from coming in contact with the nasal bone, as it does in the Ox family. Of less importance is the circumstance that the first molar tooth in each jaw has a short crown. As a rule, tusks or canine teeth are usually present in the upper jaw; and since these are always developed in those forms unprovided with antlers we have a ready means of distinction from the Ox family, in which there are never upper tusks. Moreover, with the single exception of the musk-deer, no member of the family has the gall-bladder, so constantly present in the *Bovidæ*. From both the prongbuck and the giraffe the deer are distinguished by the presence of well-developed lateral hoofs in both feet. It may also be mentioned that whereas in the *Bovidæ* these lateral toes are represented merely by the bones of the toes themselves and the terminal hoofs, a large number of deer have remnants of the lower extremities of their supporting metacarpal and metatarsal bones lying alongside of the cannon-bone. In all deer the end of the muzzle is naked, and there is a gland in front of the eye.

Distribution. Although numerically far inferior to the *Bovidæ*, the deer-tribe includes a large assemblage of species, which may be grouped under several generic headings, and have a wide geographical distribution. In the Old World deer are found over the greater part of Europe and Asia, but are quite unknown in Africa south of the Sahara—the Ethiopian region of zoologists. Three of the Old World species, representing as many genera, extend into North America; but the other New World forms, which range as far south as Chili, belong to quite a different type from any of those inhabiting the Eastern Hemisphere.

Habits. Deer are for the most part inhabitants of forests or grass-jungles, and are never found in desert districts. They are an older group than any of the other typical Ruminants, making their appearance in the lower portion of the Miocene period, where the species were of small size, and for the most part unprovided with antlers.

The Red Deer Group (*Cervus elaphus, etc.*).

The well-known red deer of Europe is the typical representative of the genus *Cervus*, and belongs to a group containing several species or varieties, which is distributed over Europe, Asia (north of the Himalaya), Northern Africa, and North America, and is mainly characterised by the conformation of the antlers. These (as shown in the illustration and in *A* of the figure on p. 340) have both a brow and

a bez-tine, and a nearly cylindrical beam, splitting up into two or more points at the summit. The tail is short, and the buttocks are marked by a light-coloured disc-like patch, which includes the tail, while the rest of the hair is uniformly coloured. All the members of the group are of large size, and their young are spotted.

Red Deer.

The red deer is characterised by the surroyals of the antlers of the adult having at least three points, and thus forming a cup in the middle of the crown; the total number of points being not less than twelve. Such a stag is called in Scotland a Royal Hart. The number of points in the crown may, however, be greatly increased, as shown in the accompanying figure of an antler dug up many years ago in an Irish bog. In the stag to which this antler belonged, the total number of points, if the two antlers were symmetrical, would have been thirty; but instances are recorded where there are as many as forty-five and even sixty-six points. The latter number must, however, be regarded as abnormal. At the present day no Scotch stag ever has antlers of the complexity of the one shown in the woodcut, and it would indeed be very doubtful if that specimen could even be matched among the living deer of Eastern Europe, where the heads are considerably finer than in Scotland. Such antlers, and even larger ones, were, however, not uncommon on the Continent a few centuries ago; many magnificent examples are preserved in some of the old German castles, the collection at Moritzburg being especially rich.

THE RIGHT ANTLER OF A RED DEER, FROM AN IRISH BOG.

A fine specimen of the red deer will stand fully 4 feet at the shoulder. The hair on the throat forms a long fringe, most developed in the pairing-season. During summer the general colour of the pelage is a bright reddish brown, the head and legs being somewhat greyer, the throat pale grey, and the patch on the buttocks yellowish white. In winter, when the fur becomes longer and softer, the colour tends to a brownish grey. Wild stags are occasionally found white; the tendency to albinism increasing in the domesticated state. A fine Scotch stag will weigh some 280 lbs. (20 stone), but they range up to 420 lbs. (30 stone), and a stag was killed at Woburn, in 1836, which weighed 476 lbs. (34 stone) as it stood. These weights are, however, exceeded by the stags of Eastern Europe and Northern Asia. The large pair of antlers mentioned above have a total length of 68 inches, and examples have been obtained from Eastern Europe and Asia Minor, varying from 46 to 48½ inches in length. The antlers of Scotch and Irish stags rarely, however, exceed 33 inches, although some of the latter may reach 35 inches. A Devonshire stag with antlers of over 38 inches is on record.

Distribution.

The red deer has a wide distribution in the temperate regions of Europe and Asia, but its eastward extension in the latter continent is not yet fully ascertained. Formerly it was probably found throughout the forest-

regions of Central Europe, but it has now been exterminated in many districts. In Scandinavia, it is found only in a few forests in Sweden, and in some of the Norwegian islands. It also remains in the larger forests of France and Germany, while it is more abundant in Hungary, Servia, Transylvania, Poland, and the Danubian States. In parts of Greece, Italy, and Spain, as well as the islands of Corsica and Sardinia, it is less plentifully represented. In the British Islands it is only in the Scottish Highlands to the north of the Clyde and the Forth that wild red deer are met with abundantly, and then only by the aid of protection. They are, however, also found on the moors of Devon and Somerset, in certain districts of Ireland, such as Killarney and Connemara, as well as in the Hebrides. As late as the reign of Queen Anne, wild deer were, however, common in Wolmer Forest, Hampshire, while a few lingered on in Epping Forest till the early part of the present century.

In European Russia the red deer is reported to be restricted to the Caucasus. Eastwards a large deer ranges through Siberia to Amurland and Northern China, which is probably only a variety of this species, although on account of the larger size of the light-coloured patch on the buttocks, it has been regarded as a distinct form under the name of *C. xanthopygus*. The red deer is again met with in Asia Minor, where it attains large dimensions, but it does not appear to enter Persia, or at least only infringes on the western borders of that country. The so-called Barbary deer of Morocco and Algiers, now regarded merely as a variety of the present species, is distinguished by the frequent absence of the bez-tine of the antlers.

Fossil remains of the red deer are found abundantly in the caverns and superficial deposits of the greater part of Europe; these fossil antlers being far larger than those of any modern representatives of the species, some of them measuring upwards of 40 inches in length.

Habits. Like most of the tribe, the red deer is gregarious; but, except during the pairing-season, the full-grown stags remain apart from the other members of the herd, and generally frequent higher ground. On the Continent this species is almost exclusively a forest-dweller, remaining concealed during the day in the thickest cover, and only venturing out to feed in the open glades or adjacent cultivated lands with the falling shades of evening. On the other hand, the Scottish red deer inhabits the open hills, and has for its only concealment the intervening glens and valleys.

The pairing-season commences in the later part of September or beginning of October, and lasts for about three weeks; during which period the venison is rank and unfit for table. At this season, writes Mr. Scrope, "the harts swell in their necks, have a ruff of long wiry hair about them, and are drawn up in their bodies like greyhounds. They now roll restlessly in the peat-pools till they become almost black with mire, and feed chiefly on a light-coloured moss that grows on the round tops of the hills, so that they do not differ so entirely from the reindeer in their food as some naturalists have imagined. . . . This is a very wild and picturesque season. The harts are heard roaring all over the forest, and are engaged in savage conflicts with each other, which sometimes terminate fatally. When a master hart has collected a number of hinds, another will endeavour to take them from him. They will fight till one of them, feeling himself worsted, will run in circles round

the hinds, being unwilling to leave them; the other pursues, and when he touches the fugitive with the points of his horns, the animal thus gored either bounds suddenly on one side, and then turns and faces him, or will dash off to the right or the left, and at once give up the contest. The conflict, however, generally continues for a considerable time, and nothing can be more entertaining than to witness, as I have often done, the varied success and address of the combatants. It is a sort of wild joust, in the presence of the dames who, as of old, bestow their favours on the most valiant. . . . In solitary encounters, there being no hinds to take the alarm, the harts are so occupied and possessed with such fury that they may be occasionally approached in a manner that it would be vain to attempt at any other time." One instance has been recorded where the antlers of two stags fighting in this manner became so firmly interlocked that the victor was unable to disengage himself from his dead antagonist, and was thus held captive until killed by a forester. After an interval of eight months and a few days from the pairing-season—that is to say, generally in the early part of June—the fawns are produced; there being but rarely more than one at a birth. The fawn is dropped in high heather, and is left concealed there during the day by the hind, who returns to visit it in the evening. Mr. Scrope states that the dam makes her offspring "lie down by a pressure of her nose; and it will never stir or lift up its head the whole of the day, unless you come right upon it, as I have often done. It lies like a dog, with its nose to its tail. The hind, however, although she separates herself from the young fawn, does not lose sight of its welfare, but remains at a distance to windward, and goes to its succour in case of an attack of the wild cat or fox, or any other powerful vermin."

RED DEER AT A POOL.

The old stags shed their antlers about February or March, according to the nature of the season, but those of the young bucks are retained for some time

longer. In spite of traditions as to the great age attained by stags, it appears that the ordinary limit of life is about twelve years, although a few individuals may survive to twenty years. Red deer are essentially shy and wary animals; and, in the open districts which they frequent in Scotland, can detect an enemy at an immense distance. When all the members of a herd are together, the chief duty of watching appears to fall on the hinds, but at other times the stags have to depend on their own alertness. When their foes are in sight, deer will watch them with the greatest coolness and circumspection, but they become anxious and restless when they have reason to suspect the near presence of a concealed enemy.

Hunting. In Scotland, deer are now killed only by driving or stalking; although wild red deer are still hunted with hounds in Devonshire, no less than 276 having been killed there in the five years ending 1892. Formerly it was the custom in Scotland to surround a large tract of country with a circle of beaters; and deer-driving on a large scale is now practised in Austria and some other parts of the continent. When hunted, as indeed at other times, red deer will take freely to the water; and when a wounded stag is hotly pursued by deer-hounds, he generally seeks refuge in the mountain streams, where his length of leg gives him a great advantage over his pursuers. Sometimes, writes Mr. Scrope, a stag "will stand upon a rock in the midst of the river, making a most majestic appearance; and in this case it will always be found that the spot on which he stands is not approachable on his rear. In this situation he takes such a sweep with his antlers, that he could exterminate a whole pack of the most powerful lurchers that were pressing too close upon him in front. He is secure from all but man; and the rifle-shot must end him. Superior dogs may pull him down when running, but not when he stands at bay." It may be added that, when disturbed, deer invariably run up wind.

Allied Species. In addition to the red deer, Asia possesses several closely allied forms, which are generally regarded as distinct species, although it may be a question whether it would not be better to consider them all as local races. One of the best known of these Asiatic deer is the hangul or Kashmir stag (*C. kashmirianus*). This species stands about 4 feet 4 inches at the shoulder, and differs from the red deer in that each antler (as shown in *A* of the figure on p. 340), usually has but five tines, so that no cup is formed at the crown, which is simply forked. Moreover, the whole beam of the antler is much curved, with the main tine of the surroyals (*e*) greatly inclined inwards; while the bez-tine is generally longer than the brow-tine, or just the reverse of the condition obtaining in the red deer. Occasionally, six or even seven points may be counted in the antlers of the hangul. In colour, this deer closely resembles the European species. Whereas, however, the call of the red deer during the pairing season is a loud squeal, ending in a more guttural tone, in the hangul it is distinctly a roar, which may be compared to that of a leopard. The antlers of the Kashmir stag average about 40 inches in length, but specimens have been obtained of which the measurements were respectively 52, 53, and 55 inches.

The true hangul is confined to the mountains surrounding the valley of Kashmir and some of the adjacent districts. There is, however, a deer from Eastern Turkestan known as the Yarkand stag, which appears to be merely a

variety of this species, distinguished by its straighter antlers and the paler colour of the fur. In Kashmir the hangul, which is essentially a forest animal, is found in summer at elevations of from 9000 to 12,000 feet. In winter, however, it descends to the valleys during heavy falls of snow; and at such times it is ruthlessly attacked by the villagers, as many as five hundred head, it is reported, having been thus slaughtered upon a single occasion. These indiscriminate slaughters, together with the more orthodox pursuit by English sportsmen, have so thinned the ranks of this fine deer, that it is now becoming comparatively rare, and unless proper means are taken for its preservation, it stands a good chance of being exterminated at no distant date.

In summer, hangul are generally found singly or in small parties, the old stags being usually solitary; but in winter they collect in herds. The antlers of the stags are usually shed about March, and the new ones do not attain their full development till October. In that month and through November the males are continually calling, and it is this time that is the proper shooting-season. The fawns are born in April, so that the period of gestation appears to be only about six months, or considerably less than in the red deer. Leith Adams states, that hangul "are seldom confined to one region, but roam from forest to forest, preferring grassy glades alternating with dense forest, where there is a copious supply of water." I have on one occasion seen a small party of these deer on the Ladak side of the mountains bounding Kashmir where there is no forest.

Far to the south-east of Kashmir, probably in the districts lying between Darjiling and Lhasa, there occurs a much larger deer, known as the shou (*C. affinis*). In addition to its superior dimensions, this deer is distinguished from the hangul by the beam of the antlers being strongly bent forwards just above the trez-tine; while the bez-tine is less constantly longer than the brow-tine. Each antler seems to have constantly but five points. Antlers have been measured of 54, 55, and $55\frac{3}{4}$ inches in length; anything like such dimensions being only very exceptionally attained by those of the Kashmir stag. The height of the animal is from $4\frac{1}{2}$ to 5 feet at the shoulder.

In the Caspian provinces of Persia, and probably also in Circassia, the red deer group is represented by the maral (*C. maral*). This is a large species allied to the last, but distinguished by the much greater length of the face, and by the crown of the antler having apparently always more than two tines. Specimens of this species in confinement kept entirely apart from some red deer inhabiting the same enclosure. These deer are said to be abundant in the thick forests of the Caspian provinces of Persia; but we know very little about their habits.

Another Old World deer of the present group, is the great Thian Shan stag (*C. eustephanus*), from the forest-regions of the mountain-barrier on the north-west frontier of Eastern Turkestan; the so-called Leudorf's stag (*C. leudorfi*), of Amurland, being in all probability not specifically distinct. The great peculiarity of this deer is, that it is so closely allied to the American wapiti, that it is very doubtful if it can be regarded as anything more than a variety of that species. The antlers have the peculiar characteristics (to be noticed immediately) of the latter; one pair having a length of 51 inches along the curve, with a basal

diameter of 10½ inches on one side, and of 11 on the other. The Thian Shan stag is said to stand 6 feet at the shoulder, but this requires confirmation.

Wapiti.

The New World representative of the present group is the well-known North American wapiti (*C. canadensis*), persistently misnamed

WAPITI CHASED BY WOLVES.

elk in its native country. The wapiti is distinguished from the hangul and the shou (to which it is more closely related than it is to the red deer) by the form and proportions of its antlers, which are characterised by their general smoothness, and the tendency to a flattening and expansion of the surroyal tines, which, in

fully adult stags, are usually three or more in number; and also by the well-marked backward curvature and want of convergence in the upper-part of the beam. In colour the wapiti is dark brown on the head and neck, while the back, flanks, and thighs are creamy grey, with the under-part of the body blackish. The legs are brown, and the lower portion of the light patch on the buttocks is bordered with black. Mr. Caton gives the height of a full-grown stag as rather more than 5 feet 4 inches (16 hands), but other writers estimate the height of the largest individuals at 5 feet 8 inches (17 hands) at the shoulder. The usual weight is about 700 lbs., but it is said that large males will exceed 1000 lbs. in weight, although some full-grown females do not scale more than 400 lbs.

In the fifth year the antlers develop five points; but after that period the number increases irregularly, and there are frequently more snags on the one antler than on the other. Very rarely is there any approach to the cup in the crown of the antler distinctive of the red deer. Antlers of the wapiti attain very large dimensions. Of two fine pairs in the collection of Mr. Otho Shaw, the dimensions are as follows, in inches,—No. 1, length 49½, span 54, basal girth 8; No. 2, length 55½, span 48¾, basal girth 7½. In two examples belonging to Mr. E. S. Cameron, the total lengths are respectively 53½ and 55¼ inches, the spans 47¼ and 44½ inches, and the basal girths just above the burr 9½ and 10 inches. The maximum recorded lengths are, however, 60¾, 61½, 62, and 62½ inches.

The range of the wapiti has of late years been greatly restricted by the advance of civilisation, while the same cause, coupled with constant persecution on the part of sportsmen, has likewise reduced its numbers in a corresponding degree. Mr. W. A. Perry states, that the wapiti was formerly found in nearly all parts of the United States, in Mexico, and in British America as far north as the 60th parallel of north latitude; but it has vanished before the approach of civilisation, and is now found only in the remotest mountain fastnesses west of the Missouri River, or in the great forests of British America. The largest herds now remaining outside of the National Yellowstone Park are found in the Olympic Mountains of Washington, and among the mountains of Vancouver Island. There are still many remaining in the Cascade and Rocky ranges, but they do not congregate there in large herds as they do in the Coast ranges. Another recent writer states, that less than ten years ago there were many secluded districts in Colorado, Wyoming, and Montana, where, during the late autumn and winter, wapiti might be seen banded together in herds numbering many thousands of individuals; whereas now, it is seldom that a hundred can be found together.

The general habits of the wapiti seem to be very similar to those of the red deer, the old stags living apart from the main herd during the greater part of the year; and in the pairing-season taking exclusive possession of a party of hinds, after having vanquished their rivals in fight. The shedding of the antlers is late, generally taking place in the full-grown stags during the latter part of December or the first half of January. The new antlers begin to sprout in March or April, and are fully complete by the middle of August. At this time the old stags begins to call, the note being a roar very like that of the hangul. It has, however, been compared to the bray of a donkey; and it is suggested that it is partly from this

that the wapiti has received the nickname of "jackass deer," bestowed upon it by the traders in the Rocky Mountains.

During May Mr. Perry states that the wapiti desert the lower hills to take refuge in the higher ranges, getting as near as possible to the snow-line without leaving the upper belt of forest. The hinds then leave the herds to give birth to their fawns in the most secluded thickets. Usually there is but a single fawn produced at a birth, although two do not appear to be very unfrequent. The hind will fight to the death in the defence of her helpless offspring against the onslaught of puma, bear, or coyote. At such times she gives utterance to a loud cry, which at once brings to her aid all the members of the herd which may be in the vicinity, and all of which unite in driving off the foe.

The wapiti is a promiscuous, not to say a coarse, feeder. Mr. Caton says that "all the grasses and most of the weeds within his reach are taken freely, and the leaves and trees of all the deciduous trees are alike enjoyed. A considerable proportion of his daily food he desires to be arboreous, yet if deprived of it he will keep in good condition on herbaceous food alone. In winter he will take the coarsest food; even that which the ox and the horse reject, he will eat freely." The venison, although unlike that of other deer, is of fine flavour, and is said to be more nutritious than any other meat.

A combat between two male wapiti during the pairing-season is described by Mr. Perry as follows: "The challenger, when approaching a band, or harem, blows a loud whistle of defiance. (Take a half-pint bottle and blow strongly into it, and the sound so produced will be similar to the call of the male wapiti during the rutting-season.) This whistle is at once answered by the ruler of the herd, who steps boldly forth to do battle with the intruder. With heads lowered between their fore-feet, the two adversaries walk around waiting for an opening, and when one is thrown off his guard the other makes a savage rush; but his opponent instantly recovers, counters the charge, and as they rush together the antlers strike each other with such terrific force that the report can be heard for a long distance. Slowly retreating, bellowing, grumbling, and grinding their teeth in a paroxysm of rage, they again circle around, and when an opportunity is afforded, make another charge, which is countered as before, The challenging wapiti usually does most of the offensive fighting until he finds (if such be the case) that he is the weaker; then he sullenly retires, bellowing as he goes. These battles are seldom fatal, and during the rutting-season are an everyday occurrence. Ugly wounds often result from them, and sometimes a prong of an antler is broken in the affray."

Wapiti differ from the majority of the deer tribe in that they do not feed during the night, although they are on the move with the first streak of dawn. From that time till about eight in the morning they continue feeding almost without interruption, after which they indulge in a midday siesta. During this midday rest they can be easily approached. About four o'clock in the evening they once more commence feeding, in which occupation they continue till dusk. In winter they are often pressed for food; and when the snow lies deep on the ground each party occupies a small area, over which the snow is trampled down as hard as ice, while all the trees are gnawed bare both of bark and leaves as high as the animals can reach.

When wapiti were found on the great prairies, the Indians were accustomed to hunt them on horseback by forming a wide circle of mounted men, from whom a certain number were detached to harass the unfortunate animals until they were brought to a standstill. Another favourite method was by forming a cordon of horsemen and driving a whole herd over a precipice. At the present day the more sportsman-like method of hunting is, however, almost exclusively employed; and it appears that the wapiti is an animal far less difficult to approach than the red deer, while it is killed by a comparatively slight wound.

The Japanese Deer Group (*Cervus sika, etc.*).

The prettily-marked Japanese deer represents a group differing from the last by the antlers having no bez-tine, so that each has usually but four points; and also by the coat being spotted with white in summer, although uniformly brown during winter. Moreover, the proportionate length of the tail is much greater than in the red deer group; and the large white patch on the buttocks is completely bordered with black. All the deer of this group are of medium dimensions, and for the most part inhabitants of Eastern Asia.

The Japanese deer, from Japan and North China, stands somewhat lower at the shoulder than a fallow deer, and has the ground-colour of the fur dark or yellowish brown, with the greater part of the tail white. These deer are very abundant in North Japan and parts of China, where they frequent dense forest, generally in hilly regions. The only way of shooting them is by beating the country with a large number of men. The Japanese deer has been introduced into several parks in Ireland and England, where it thrives well, sometimes interbreeding with the red deer.

Mantchurian Deer. The Mantchurian deer (*C. mantchuricus*), of Northern China, may probably be regarded merely as a larger variety of the last, in which the coat is generally darker coloured, with a larger dark area on the upper surface of the tail.

Dybowski's Deer. Dybowski's deer (*C. dybowskii*), from Mantchuria, appears, however, to be a distinct species of relatively large size, easily recognised by its pure white muzzle. The ordinary length of the antlers is about 22 inches, but a pair, having five tines each, which have been referred to this species, measure upwards of $35\frac{1}{2}$ inches.

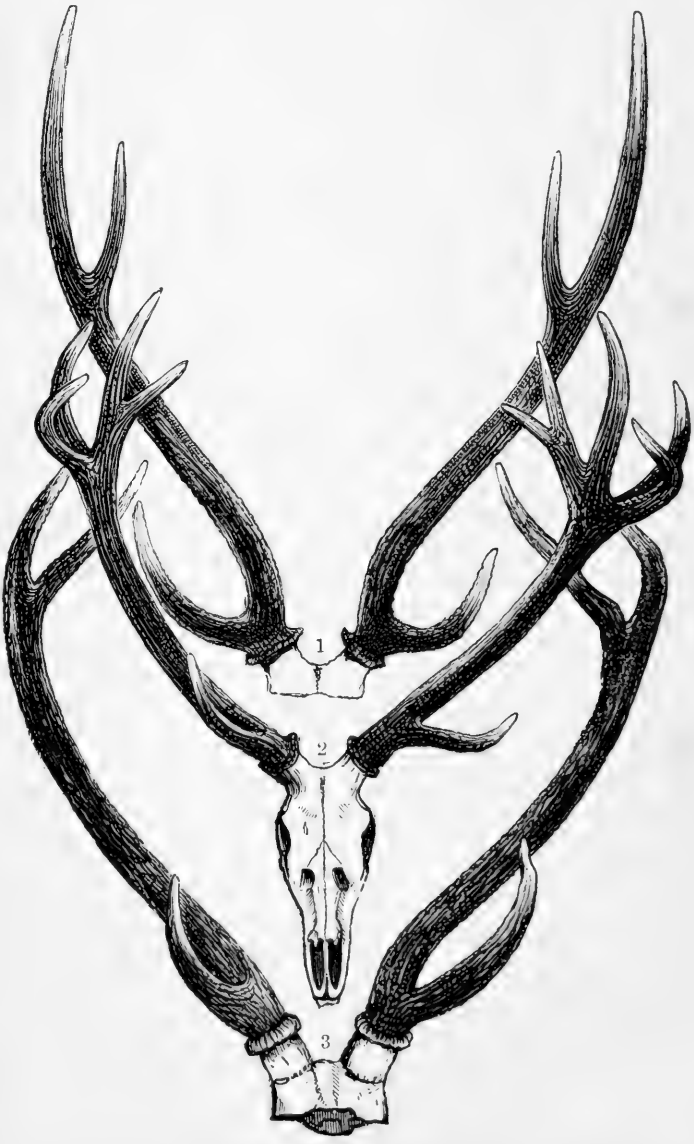
Formosan Deer. Better known than the last is the Formosan deer (*C. taëvanus*) from the mountains of the island from which it takes its name. The body-colour is lighter than in the other species, while the spots have a tendency to persist during the winter; the tail being white with a black streak down the middle of the upper surface. These deer are caught in traps by the inhabitants of Formosa, by whom, as well as by the dwellers on the island of Samasana, they are kept as pets.

Caspian Deer. Lastly, we have the imperfectly-known Caspian deer (*C. caspicus*) from the Talish Mountains, near the south-western extremity of the Caspian Sea in Northern Persia, which has been provisionally assigned to the present group. If rightly thus placed, this species is of interest as showing that the group is represented in Western, as well as in Eastern Asia. The one skull, on

the evidence of which the Caspian deer was considered to represent a distinct species, differs from that of the other members of the group in that the antlers have only three points when fully adult, namely, a brow-tine and a fork at the extremity.

The Indian Spotted Deer, or Chital (*Cervus axis*).

The spotted, or axis deer, of India and Ceylon, is our first representative of two very closely allied groups of Indian deer, in which the cylindrical antlers have but three tines on each side; the bez-tine being absent, and the beam terminating in a simple fork. In the spotted deer, of which a single antler is shown in C of the figure on p. 340 and a pair in the upper figure of the accompanying woodcut, the bez-tine of the antlers is given off nearly at a right angle with the beam. The whole length of the antlers is about three times that of the skull in average specimens; and the hinder tine of the terminal fork is considerably longer than the one in front.



ANTLERS OF INDIAN SPOTTED DEER (1), SWAMP-DEER (2), AND SAMBAR (3).

The spotted deer or, as it is called in India, the chital or chitra, varies considerably in height in different localities, buck from Northern and Central India standing, according to Blanford, from 3 feet to 3 feet 2 inches at the withers, whereas in Southern India the height seldom exceeds from 2 feet 6 inches to 2 feet 8 inches. The neck and throat of this deer are devoid of any

mane; the tail is relatively long, pointed, and thin; and the cheek-teeth are characterised by the great height of their crowns. The ground-colour of the fur is a rufous fawn; the whole of the body being marked by a number of large white spots, which are present at all ages of the animal throughout the year, and tend to arrange themselves in longitudinal lines. The head and neck are of a uniform brownish colour, and there is a black line running from the nape of the neck to the end of the tail. White prevails on the inside of the ears, the chin, the upper part of the throat, the under-parts of the body, and the insides of the limbs, as well as on the under surface of the tail. As in the case of the fallow deer, a blackish variety is occasionally met with, in which the spots are only very faintly indicated. An individual standing close upon 3 feet in height weighed 145 lbs.

Although the antlers of the spotted deer are typically but three-tined, there are not unfrequently a number of small points or "sports" at the junction of the brow-tine with the beam; but such sports are rare higher up. The average length of the antlers of the larger race of this species may be given as about 30 inches; but examples reaching 38 and $38\frac{3}{4}$ inches in length, with a girth of $5\frac{3}{4}$ inches above the burr, have been recorded. Great difference exists in regard to the degree of divergence or span of the antlers; thus, in two examples of which the respective lengths were 34 and $34\frac{1}{2}$ inches, the span in the former case was only 24 inches, against $30\frac{1}{2}$ inches in the other.

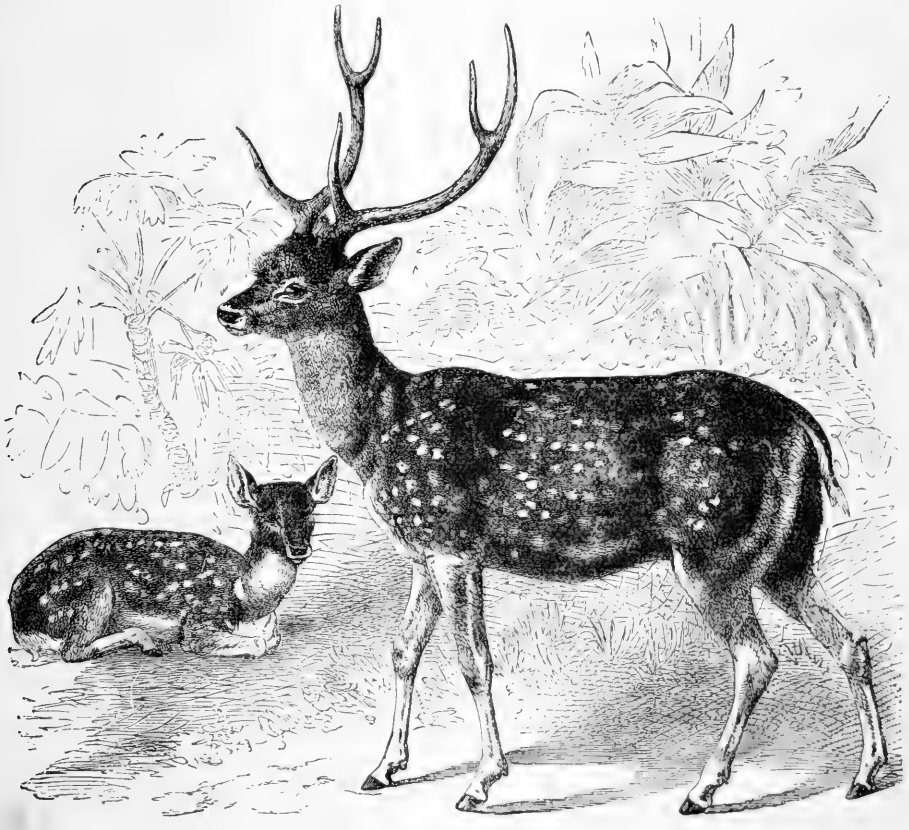
Distribution. This deer is found nearly throughout India and Ceylon, but in the Himalaya it only occurs on the outermost spurs, and it is unknown on the plains of the Punjab, Sind, a large part of Rajputana, Assam, and the whole of the countries to the eastward of the Bay of Bengal. On the hills of Southern India it is found at elevations of from three to four thousand feet above the sea. It has been introduced by Sir E. G. Loder into his park near Horsham.

Habits. The native name chital refers to the dappled hide of this deer, which is, perhaps, the handsomest member of its tribe as regards colour and form, and is certainly one of the most characteristic of the mammals of India. Mr. Blanford states that it is most generally found among bushes or trees in the neighbourhood of water, and in bamboo-jungles, while it frequents both hilly tracts and plains, and never wanders far from its drinking places. "So long," writes the author named, "as it has a wild tract of bush or ravines for shelter, it appears to care little for the neighbourhood of man. Many of its favourite haunts are in some of the most beautiful wild scenery of the Indian plains, and lower hills, on the margins of rippling streams with their banks overgrown by lofty trees, or in the grassy glades that open out amidst the exquisite foliage of bamboo clumps. Spotted deer are thoroughly gregarious and associate at all times of the year in herds, sometimes of several hundreds. They are less nocturnal than sambar, and may be found feeding for three or four hours after sunrise, and again in the afternoon for an hour or two before sunset. They generally drink between eight and ten o'clock in the morning, the time varying with the season of year, and repose during the day in deep shade. They swim well, and take readily to water. They both graze and browse."

It appears that there is a great range of individual variation as regards the date of the pairing-season and the shedding of the antlers; bucks with fully-

developed antlers being met with at all times of the year. In Northern India the pairing-season seems, however, to be generally during the winter; although young fawns may apparently be met with at any season.

As regards its usual habits, General Kinloch writes that "the chital is a shy and retiring animal, lying quiet in the densest thickets during the heat of the day, and if disturbed generally attempting to elude observation by concealment, or by trying to sneak quietly away. I have often, when beating for tigers, seen a cunning old stag with his head down silently creeping away through the jungle, sometimes passing almost under the elephants. When on foot, I have known a



THE INDIAN SPOTTED DEER ($\frac{1}{15}$ nat. size).

herd come quietly past within two or three yards of me in thick cover, and even at that short distance have had difficulty in getting a shot. It might be supposed that such a brightly-coloured animal would be very conspicuous in the forest, but this is far from being the case; unless it moves, few beasts are more difficult to see; the colour of the skin harmonises with the dead leaves and grass, while the white spots are indistinguishable from the little flecks of light caused by the sunshine passing through the leafy branches. Chital generally assemble in herds of from ten to thirty, among which are probably two or three stags, but occasionally herds of hundreds are met with. On being disturbed, and especially on detecting the presence of a beast of prey, the chital utters a sort of shrill bark, and many a time

has this cry betrayed a tiger to the sportsmen. The stag's cry is a peculiar moaning sort of bellow, and is generally to be heard at night. Immense numbers of spotted deer are frequently met with when beating for tigers, and many are shot off elephants in this way. In long grass it is of course only possible to shoot them from elephants, but however satisfactory it may be to bowl over a stag in full career by a clever snap-shot from the howda, it cannot, in my opinion, compare with the pleasure of stalking and shooting the same animal on foot, where the nature of the country renders it possible." The months of March, April, and May are the best for chital-shooting on foot in the valleys and low hills on the flanks of the Himalaya. Remains of deer apparently nearly allied to the chital are found in the Pliocene formations of the south of France.

The Sambar Group (*Cervus unicolor, etc.*).

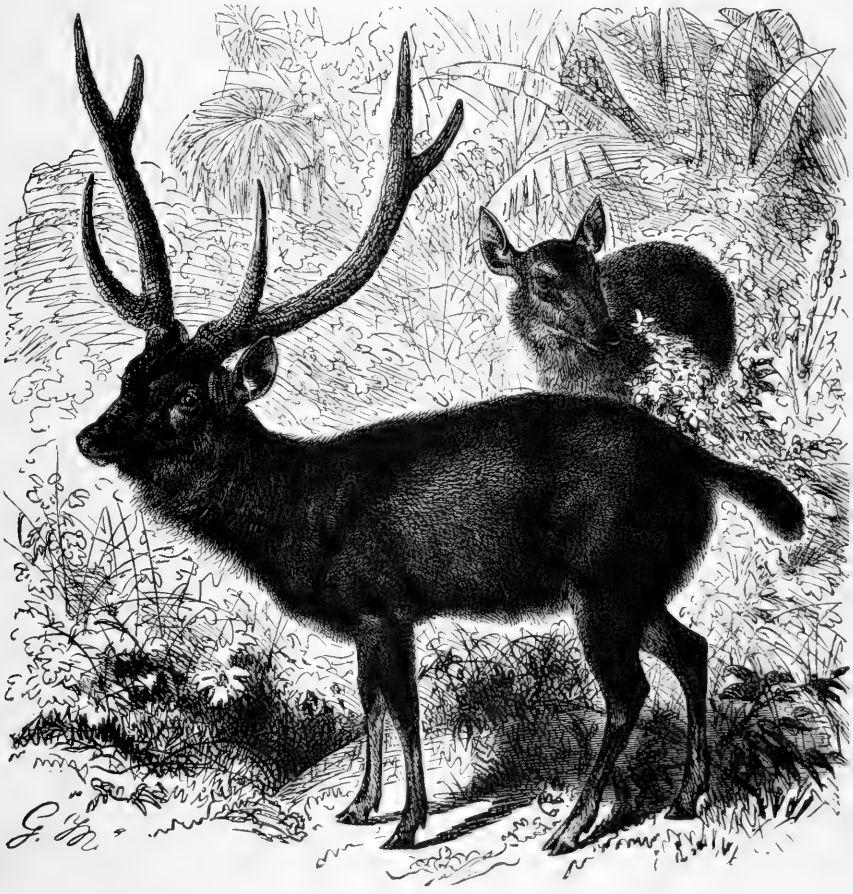
Nearly allied to the chital is a group of deer from South-Eastern Asia, distinguished by the brow-tine of the three-pronged antlers forming an acute angle, instead of nearly a right angle, with the beam, as shown in the figures on pp. 340, 353. The majority of this group are peculiar in that they are uniformly coloured at all ages, although in two forms the young are spotted, while in one case this type of coloration persists in the adult.

The well-known Indian sambar is the largest member of this group, as it is the largest of all the true deer, next to the representatives of the red deer group. Externally the sambar is characterised by its coarse wiry hair, which on the neck and throat of the adult male is elongated to form an erectile mane. The ears are large and broad, and the tail thick and of moderate length. In colour the fur is a nearly uniform dark brown throughout, tending, however, in some individuals to a more or less well-marked yellowish, and in others to a greyish tinge. The chin, under-parts, and inner surfaces of the limbs, are always yellower, and may be yellowish white. In the ordinary form the young are likewise uniformly coloured, but there is said to be a variety in Cachar of which the fawns are spotted. The height of the buck varies from 4 to 5 feet, and possibly rather more at the withers; and large specimens have been killed weighing 560 lbs. (40 stone) and 700 lbs. (51 stone).

The antlers are generally characterised by their rough external surface, and their freedom from sports; while in Indian examples the two tines of the terminal fork are nearly equal in length, although in other districts there is great variability in this respect. In India fine horns attain a length of about 36 inches, but these dimensions are seldom reached in the countries to the eastward of the Bay of Bengal. As regards shape and girth, there is a great amount of variation in sambar horns. In a fine pair, of which the extreme length was $38\frac{1}{2}$ inches, the span was $37\frac{3}{4}$ inches, and the basal girth $8\frac{7}{8}$ inches; whereas in another pair, while the length was only $32\frac{1}{2}$ inches the span was 38 inches and the girth 9 inches. The longest recorded pair measured 48 inches in length, but their girth at the middle of the beam was only 6 inches, against $8\frac{1}{2}$ inches in a pair measuring 38 inches in length. Perhaps, however, the finest known pair is one in which the length is 44 inches, the span $45\frac{3}{4}$ inches, and the girth just above the brow-tine $7\frac{3}{4}$ inches. There is

likewise an equally-marked difference in regard to the degree of development of the ridges and furrows on the antlers.

Distribution. The sambar occurs typically in the wooded undulating or hilly districts of India and Ceylon; but Mr. Blanford concludes that the smaller Malayan and Burmese forms, which have been described under the names of *C. hippelaphus* and *C. equinus*, are not specifically separate; although the front-tine of the terminal fork of the antlers is much shorter than the back one, instead of



THE SAMBAR ($\frac{1}{15}$ nat. size).

the two being subequal. The range of the sambar accordingly extends from India to the Malayan Islands, and thus covers nearly the entire Oriental region. In the Himalaya it may range to elevations of nine thousand or ten thousand feet; and it is commonly found on the highest mountains of Southern India and Ceylon. It is but seldom seen on the alluvial plains frequented by the chital, and is absent from the sandy plains of Sind, the Punjab, and Rajputana.

Habits. Mr. Blanford observes that the sambar "is the woodland deer of South-Eastern Asia generally, and is more widely and generally distributed than any other species. Although it does not shun the neighbourhood of

man to the same degree as *Bos gaurus* does, it is only common in wild tracts of country. It comes out on the grass slopes, where such exist, as in the Nilgiris and other hill-ranges, to graze, but always takes refuge in the woods. It is but rarely found associating in any numbers; both stags and hinds are often found singly, but small herds from four or five to a dozen in number are commonly met with. Its habits are nocturnal; it may be seen feeding in the morning and evening, but it grazes chiefly at night, and at that time often visits small patches of cultivation in the half-cleared tracts, returning for the day to wilder parts, and often ascending hills to make a lair in grass amongst trees, where it generally selects a spot well shaded from the sun's rays. It feeds on grass, especially the green grass near water, and various wild fruits of which it is very fond, but it also browses greatly on shoots and leaves of trees. It drinks, I believe, daily, though Mr. Sterndale doubts this; it certainly travels long distances to its drinking-places at times." As regards the date of the pairing-season and the time of shedding the antlers, there appears to be even a still greater amount of variation than is the case with the chital; and it is stated on good authority that stags have been known to retain their antlers for two or more years. It appears, however, that in peninsular India the pairing-season usually takes place in October and November, although in the Himalaya it occurs in the spring. Similarly, while in the former area the antlers are most frequently shed in March, in the latter the shedding-time is deferred for a month later. Usually there is but one fawn at a birth.

During the pairing-season sambar assemble in large numbers, and at that time the old stags utter at morning and evening, and sometimes in the night, loud roarings, which have been described as a "metallic-sounding bellow."

Sambar are very tenacious of life, and require a well-placed bullet to bring them to the ground. They are usually either stalked or driven by a line of beaters; but Sir Samuel Baker, when in Ceylon, was in the habit of hunting them with hounds, and giving the *coup-de-grâce* with a knife. Describing his experiences in that country, Sir Samuel writes that "we never drove the jungles with beaters, but simply strolled through the most promising country, either upon ponies or on foot, and took our chance of any game that we might meet. I rarely met sambar in the low country; and when living on the mountains at Newera Ellia, 6200 feet above the sea, shooting was out of the question. Although the interminable forests of that elevated district abounded with these animals, I have never seen one, unless discovered by the hounds. The jungles are thick, and it is impossible to get through them without noise and considerable exertion. The animals of course are alarmed, and retreat before you are near enough to hear their rush. I have often taken my rifle and sallied out before sunrise upon the wild *patinas* (open ground), where nature rested in profound solitude; but I have never seen a sambar in the open."

The hunting was conducted with a mixed pack of about fourteen couple of hounds of various breeds, which were found better suited to this kind of sport than pure-bred foxhounds; and the pack was always directed to the neighbourhood of a stream, where the scent would be freshest, as the sambar drinks before retiring to the densest depths of the jungle, in order to enjoy its day's repose. The speed of the sambar is, according to Mr. Blanford, but very moderate; and on the rare

occasions when these deer are found in open country, any good horse which is not overweighted by its rider, ought to have no difficulty in running them down.

Allied Species. In the islands of the Malayan region there occur several small sambar-like deer, in regard to which it is difficult to determine whether they indicate races of the ordinary sambar which have been introduced by the natives, and have gradually dwindled in size, or whether they are entitled to rank as distinct species. Such is the Timor deer (*C. timorensis*), a small, thick-set animal, scarcely half the size of the smaller race of the true sambar; and also the Moluccan deer (*C. moluccensis*), in which the general build is more slight and graceful. In the Philippine and Ladrone Islands, there occurs another of these small sambar-like deer (*C. philippinus*), belonging to the variety in which the anterior tines of the antlers are shorter than the posterior. This form is scarcely larger than the under-mentioned hog-deer, but its build is more slender, and the colour a uniform dark brown, save for a pale ring round each eye, and the white on the under-parts of the tail and the inner surface of the thighs.

On the other hand, there can be no doubt as to the specific distinctness of Kuhl's deer (*C. kuhli*), from the Bavian Islands between Borneo and Java. This deer, while resembling most of the forms noticed above, in that its fur has the same uniform coloration throughout life, differs in having a skull resembling that of the hog-deer, and displaying the same absence of tusks in the upper jaw. The colour of the fur in this deer is pale brown; but the individual hairs are ringed with alternate tints, instead of having the uniform hue of those of the hog-deer.

Very different from all the other members of this group is Prince Alfred's deer (*C. alfredi*), from the Philippines, which resembles the chital in having at all ages and all seasons a spotted coat. This deer stands about $2\frac{1}{2}$ feet at the withers; and its colour is a dark chocolate-brown, with about six longitudinal rows of somewhat indistinctly-marked yellowish spots. The antlers are comparatively short, and have the front tine of the terminal fork directed inwardly, while the outer surfaces of the ears are nearly devoid of hairs.

Hog-Deer. The last and smallest representative of this group is the hog-deer, or para (*C. porcinus*), of India and Burma, which stands only some 24 inches in height at the withers. In build, this species is characterised by the relative shortness of its legs, while the tail is rather long, and there is no mane on the neck and throat. The comparatively short antlers are mounted on very long bony pedicles, and after giving off the brow-tine have a nearly straight beam till the small terminal fork, the front branch of which is longer than the hind one. There are no tusks in the upper jaw. In colour, the fur of the para is brownish, with a more or less decided yellowish or reddish tinge; each hair being tipped with white, so as to produce a speckly appearance. The under-parts are paler, and the under surface of the tail and the insides of the ears white. The fur becomes paler in summer, and is then generally marked with light brown or white spots, which may be limited to one or two rows on either side of a dark streak down the back. The young have the whole body spotted, till they attain the age of some six months. The antlers seldom exceed 10 or 12 inches in length.

In India the hog-deer is confined to the great Indo-Gangetic plain, where it

ranges from Assam to the Punjab and Sind, and is quite unknown in the peninsula, though a small colony has been introduced into Ceylon. It occurs along the Terai at the foot of the Himalaya; and from Assam its range extends into Burma and Tenasserim.

The para swarms on many of the low alluvial plains of India, to which situations it is mainly, if not exclusively, restricted. Here it frequents the grass-jungles of moderate height, avoiding the taller ones which give shelter to the buffalo and rhinoceros. Sometimes, however, they may be met with among trees. As a rule, hog-deer are solitary creatures, and it is but seldom that more than two or three are found together, although several may inhabit one patch of jungle. The pairing-season is said to be in September and October; and the antlers are generally shed in April.

The hog-deer is an ungainly animal when moving, and General Kinloch states that both "its English and specific names have been derived from the hog-like manner in which it rushes through the long grass when disturbed; keeping its head low down, and galloping without that bounding action which characterises most deer." Hog-deer are generally shot from elephants and afford good sport, although they are difficult to hit, since as a rule the only indication of their presence is a sudden rush in the long grass, in the direction of which the sportsman must fire. General Kinloch says, that "hog-deer may be speared on favourable ground, and give splendid runs; they are very fast, and usually give a much longer chase than a boar. I have heard of instances of their deliberately charging a horse; and with their sharp horns they can inflict a very severe wound."

The Swamp-Deer Group (*Cervus duvauceli, etc.*).

The swamp-deer, of which the antlers are figured in the woodcuts on pp. 340 and 353, differs from all the Indian deer hitherto noticed, in that the antlers carry more than three tines. This distinctive character of the swamp-deer has not escaped the notice of the natives of India, by whom it is designated barasingha, that is, "twelve-tined." This deer is a rather large species, the bucks standing from 3 feet 8 inches to 3 feet 10 inches at the withers. The neck is maned, the tail of moderate length, the muzzle long, and the hair rather fine and rather woolly. The antlers are smooth and somewhat flattened, and give off the brow-tine nearly at right angles to the beam; after which the beam continues without branching for a considerable distance, finally dividing into a fork, of which the two prongs again branch. Generally, as in the figure on p. 353, the inner branch of the main fork has two, and the outer three tines, but the number of points is often much greater, reaching from sixteen to twenty, or even more. In its winter dress the colour of the swamp-deer is yellowish brown above and paler underneath; but in summer the upper-parts are reddish brown, generally more or less spotted with white, while the under-parts and the lower surface of the tail are pure white. The young are spotted.

Average-sized antlers of the barasingha measure about 30 inches along the curve; but a length of 38 inches has been recorded. Large stags have weighed from 460 to 570 lbs. (32 stone 12 lbs. to 40 stone 10 lbs.).

Distribution. The swamp-deer is confined to India, where it has a local distribution; being found along the foot of the Himalaya, from Assam to some distance west of the Jumna, and in some districts in the Indo-Gangetic plains, such as the Bengal sandarbans and Rohri in Sind. It is also common in certain portions of Central India, especially in the valley of the Narbada, where its habitat is limited to the area clothed with forests of the sal tree.

Habits. The swamp-deer, although sometimes found in open forest, generally keeps in the outskirts of the woods, and frequents flat or undulating grass-lands, more or less interspersed with trees. In winter it is gregarious, herds of from thirty to fifty head being frequently met with, while in some districts herds of several hundreds have been observed during September and October. In Assam the bucks are met with singly, with the antlers for the most part still in the velvet, so that the shedding-time is probably, as a rule, not later than February. The swamp-deer is mainly a grazer, and it is said to be much less nocturnal in its habits than the sambar, being not unfrequently seen grazing in the forenoon, and again early in the afternoon.

Schomburgk's Deer. Schomburgk's deer (*C. schomburgki*), of Siam, is an allied species, of which the antlers, as shown in the figure on this page, are distinguished by the extreme shortness of the beam below the bifurcation, and the great length of the brow-tine. Each antler usually carries five points; and specimens vary in length from 27 to 30 inches in good examples.

HEAD OF SCHOMBURGK'S DEER.
(From Sclater, *Proc. Zool. Soc.*, 1877.)

Eld's Deer. An altogether unique form of antler is that of Eld's deer (*C. eldi*), as shown in the figure on p. 340. Here the brow-tine curves down over the forehead, so as to form an almost continuous sweep with the beam; the latter being curved at first backwards and outwards, and then slightly forwards, after which it divides into a short fork, of which the two prongs may split up into as many as eight or ten points. The upper surface of the brow-tine often carries a number of short points, and there is very generally a distinct snag at the point where that tine joins the beam. In some cases the upper part of the beam is much flattened. In height this species stands nearly the same as the swamp-deer. In winter the colour of the fur of the bucks is dark brown, tending to black, but in summer it is fawn-coloured, nearly like that

of the does at all seasons; the under-parts being pale brown in winter and white in summer. The fawns lose their spots at an early age. In the winter the hair is coarse and very shaggy. Average-sized antlers measure about 40 inches from the tip of the brow-tine along the curve to the extremity; but one specimen of 54, and another of 59 inches have been recorded.

Eld's deer frequents low swampy grounds in Manipur, Burma, the Malay Peninsula, Cambodia, and the island of Hainan. Mr. Blanford states that they are "usually seen in herds of from ten to fifty or more; but occasionally much larger numbers are found associating. They may enter the fringe of the forest in places for shade, during the day, but they generally keep in the open plain. In some places in the Irawadi delta, and in Martaban, they are found in plains, where, during the dry season, no fresh water is procurable. They are frequently seen in swamps, and feed on wild rice and other plants growing in such places." The period of shedding the antlers varies from June in Manipur to September in Lower Burma. The hinds utter a short barking grunt, while the call of the stags is a more prolonged sound of the same nature.

David's Deer (*Cervus davidianus*).

Mantchuria, or some neighbouring region in Northern China, is the habitat of a remarkable deer differing from all other Old World types in the absence of a brow-tine to the antlers. Instead of the brow-tine, each antler has a single very long and nearly straight tine given off just above the beam, and directed backwards; above which the beam ascends for a considerable distance, and then forks. The normal number of points on each antler is accordingly three, but this may be increased by a splitting of each tine of the fork. It appears that the long back-tine represents the hinder branch of the antler of the swamp-deer, and the terminal fork the front branch of the latter. David's deer is of about the same size as the swamp-deer, and is clothed with long and rather shaggy hair, while the tail is of unusual length, and also thickly haired. It has been stated that the fawns are uniformly coloured, but this requires confirmation.

These deer are kept in the imperial hunting-park at Pekin, and specimens have been exhibited alive in England, but we have no information as to their habits in the wild state. The largest antlers on record have a length of $32\frac{3}{4}$ inches.

The Fallow Deer Group (*Cervus dama, etc.*).

The fallow deer is the representative of a distinct group of the genus *Cervus*, characterised by the antlers being rounded at the base, but widening in the upper part into a flattened palmate expansion. In front there is a large brow-antler, forming rather more than a right angle with the beam, above which there is a trez-tine given off at some distance below the commencement of the palmation; while the hinder edge of the latter carries three or four small sharp snags, of which the lowest is longer and placed considerably below the others, so that it may rank as a distinct back-tine.

In height the fallow deer usually stands nearly 3 feet at the withers, and has

a small head, large ears, and a relatively long tail. The general colour of the fur is some shade of fawn or yellowish brown, darker on the head and neck, and marked on the body with a number of large white spots. The under-parts, inner sides of the limbs, and the under surface of the tail are white; and there is a dark line running down the back from the nape of the neck to the end of the tail. There is, however, a dark brown variety in which the spots are scarcely distinguishable, or wanting, and specimens may be seen exhibiting every gradation in colour from pure white nearly to black. The hair is comparatively short and fine, and there is no mane on the neck and throat. The upper jaw has no tusks. Good antlers vary in length from 19 to 27 inches, 28¼ being the maximum length on record.

Distribution. The fallow deer is a native of Northern Africa and the countries bordering the Mediterranean, and in a wild state is still abundant in Sardinia, Spain, and some of the islands of the Grecian Archipelago. From these countries it has been introduced into Central Europe, where it flourishes well, although needing some protection during the winter in the more northerly regions. At what period this introduction took place is, however, quite uncertain, although in Britain it was evidently many centuries ago. From the occurrence of antlers of the general type of those of the fallow deer in some of the superficial deposits, it has been supposed that this species was really an indigenous British animal. These fossil antlers belong, however, to an extinct although nearly-allied species, known as *C. browni*, and there is no evidence of the occurrence of fossil remains of the true fallow deer in this country.

Bell observes that "fallow deer are gregarious to a great extent, associating in large herds, the bucks apart from the does, except in the pairing-season and early winter, when the sexes consort in company. Most persons must be familiar with their boldness and the confident manner in which they will approach mankind, where they are well accustomed to his presence. . . . Like the other species, the fallow deer feeds on herbage. It has been noted that it is especially fond of horse-chestnuts, which the bucks knock down from the branches with their antlers, and this tree is consequently frequently planted in deer-parks. The pairing-season begins in September, and the doe goes eight months with young." As a general rule but a single fawn is produced at a birth, although there may occasionally be two. The alleged instances of triplets appear to be incorrect. The young male exhibits the first signs of his antlers in his second year, when they make their appearance as simple snags; the animal being then called a pricket. In the fifth year the antlers attain their full development, although some additional small points may be added in the following season.

It has been stated that the dark variety of the fallow deer was introduced from Norway by James the First, on account of its hardy constitution. This, however, has been proved to be incorrect by Mr. Harting, who has shown that this breed existed in Windsor Park as far back as the year 1465. The fallow deer of Windsor Park include both the spotted and the brown breeds; but in Epping Forest only the latter occur.

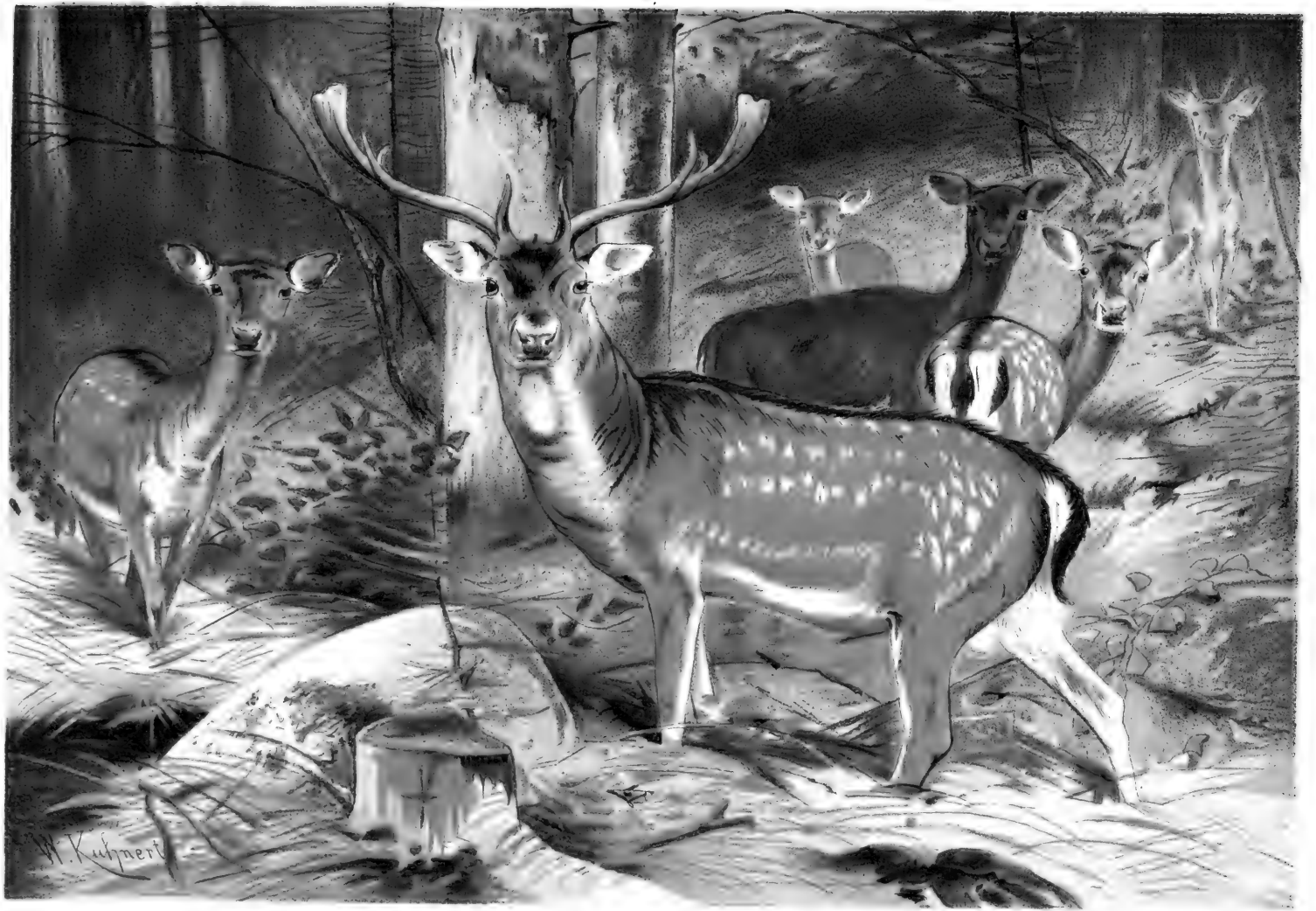
Writing of the fallow deer of Epping, Mr. Harting states that they "have held their own, in spite of all difficulties, until the present time, and have strangely

preserved their ancient character in regard to size and colour. Locally they are referred to as 'the old forest breed,' and are comparatively small in size, of a uniformly dark brown colour, and with very attenuated antlers—peculiarities which have no doubt been brought about by continued isolation, without the admixture of any fresh stock for many generations. It is remarkable that no individuals of the true fallow colour (*i.e.* yellow dun) or spotted with white are ever seen in this forest. This in some measure proves the antiquity of the stock, which would otherwise show in their progeny a reversion to one or other of these varieties, which elsewhere are so common. The keepers assert that not only are there no spotted or fallow varieties here, but that they have never observed any spotted fawns, the latter being dark like their parents. If this observation be correct, it is very remarkable; for it is generally supposed that the fawns of all fallow deer are spotted at birth, and that, except in the permanently spotted variety, the spots disappear with age. The attenuation of the antlers is also very noticeable, the palmation being reduced from a hand's-breadth to about the width of two fingers. There can be no doubt that, from long isolation and continued breeding in and in, the herd has considerably degenerated. . . . At present [1884] the number of fallow deer in Epping Forest is estimated to be about eighty or one hundred head. They do not associate in one herd, but roam about in small parties, keeping to the thickest underwood and most unfrequented parts of the forest." The venison of the fallow deer is generally considered superior to that of the red deer.

Persian Fallow Deer. The Persian fallow deer (*C. mesopotamicus*), from the mountains of Luristan, in Mesopotamian Persia, differs from the ordinary kind in that the trez-tine of the antlers is placed nearer to the small brow-tine, and that the main palmation of the beam takes place below instead of above the middle of the length. The two species are, however, very closely allied, and will freely breed together. The Persian species appears to be always spotted.

Extinct Irish Deer. In this place may be noticed two extinct deer from the superficial deposits of Europe, which appear to be nearly related to the fallow deer, although of course it is impossible to tell now whether they had spotted or uniformly-coloured coats. The first and largest of these is the gigantic Irish deer (*C. giganteus*), often, but incorrectly, spoken of as the Irish elk, in which the widely-palmated antlers were larger and more massive than in any other species. In this magnificent deer the antlers have a short and nearly cylindrical basal portion of the beam, given off almost at right angles to the axis of the skull. Above the burr there is a descending brow-tine (*b*) which is flattened and generally forked. As soon as the beam expands it gives off from the front edge a trez-tine (*c*), and nearly opposite to it, on the hinder edge, a back-tine (*h*), corresponding to the one similarly situated in the fallow deer. Above these tines the antlers expand to their fullest width, and generally terminate in five or six snags, of which the topmost have a nearly upright direction. In unusually fine examples the antlers of the Irish deer may have a span of over 11 feet from tip to tip, and the height of the animal was fully 6 feet at the shoulder.

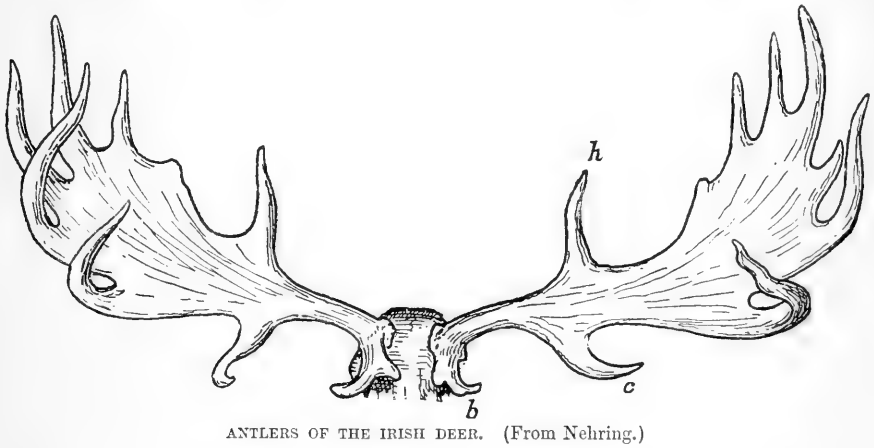
Although the Irish deer takes its name from the common occurrence of its remains in the bogs of Ireland, it is by no means confined to that country, but is found in the caverns and superficial deposits of England and parts of Scotland, as



FALLOW DEER.

well as on the Continent, where its range extends from Italy in the south to Russia in the north. That the Irish deer lived within the human period is proved by the occurrence of its remains in association with stone implements. It has, indeed, been considered that the word *Schelk*, which occurs in the Nibelungenlied of the 13th century, refers to the Irish deer, but Prof. Nehring is of opinion that it more probably means either an elk or a wild stallion.

The Irish deer differs considerably from the fallow deer in the form and direction of its antlers, but a connecting link between them is found in Ruff's



ANTLERS OF THE IRISH DEER. (From Nehring.)

deer (*C. ruffi*), from the superficial deposits of Germany, which was of somewhat inferior dimensions to the former. In Ruff's deer the antlers are directed upwards and outwards nearly after the fashion obtaining in the fallow deer, while the plane of the palmated portion is placed in the same longitudinal direction as in the latter. Moreover, the terminal snags are shorter and inclined more inwardly than in the Irish deer, but the flattened and expanded form of the brow-tine indicates a closer connection with the latter.

The Muntjacs.

Genus *Cervulus*.

The small Asiatic deer, commonly known as muntjacs, differ so decidedly from all those hitherto noticed that they are referred to a distinct genus. They are distinguished from all the members of the genus *Cervus* by their short, simple, two-tined antlers being mounted on pedicles of the skull, which are as long or longer than the antlers themselves, and diverge from the middle line of the lower part of the forehead, where they commence as rib-like bars. From this feature these animals are often spoken of as rib-faced deer. The brow-tine of the antlers is short and directed upwards, while the tip of the undivided beam is more or less inclined inwards. The skull has a very large depression for the reception of the gland below the eye; and the bucks are furnished with long projecting tusks in the upper jaw. The lateral toes are peculiar in that they consist of only the hoofs, without any trace of the bones of the digits themselves.

The muntjacs are confined to India, Burma, and the Malayan region, and evidently indicate a very ancient and generalised type of the Deer family. They appear to be represented in the Pliocene formations of Europe, and are probably nearly related to a still earlier group of extinct European deer, known as *Palæomeryx*, in which the antlers were either totally wanting, or of very small dimensions.

Indian Muntjac. The best known representative of the group is the common Indian muntjac, also known as the barking deer, and in Hindustan as the kakar (*Cervulus muntjac*). This animal stands from 20 to 22 inches in height at the shoulder; and has fur of a deep chestnut colour, becoming darker on the back, and paler and less brilliant below; the chin and upper part of the throat, as

THE INDIAN MUNTJAC

well as the hinder portion of the under surface of the body, and the inner sides of the thighs and lower surface of the tail, being white. The face and limbs are brown, and there is a black line on the inner surface of the pedicles of the antlers, extending some distance down the ribs on the face. The antlers are generally only some 3 or 4 inches in length, on pedicles of some 4 or 5 inches, but sometimes reach the length of 5, and, it is said, even 11 inches.

Distribution. The kakar is essentially a forest-dwelling deer, and appears to be restricted to hilly regions. Its range includes suitable districts throughout India, Ceylon, and Burma, whence it extends through the Malay Peninsula to the islands of Sumatra, Java, Borneo, and Hainan.

Habits. These deer are solitary creatures, usually found singly or in pairs; the name of barking deer being derived from their peculiar cry. On

this point General Kinloch observes that many visitors to the various hill-stations of the Himalaya, who may never have seen a kakar, must probably be well acquainted with its voice, which is wonderfully powerful for such a small animal. It is rather difficult to convey a correct idea of it by words, but it may perhaps be best described as a hoarse resonant bark. The cry may frequently be heard in the mornings and evenings, and it is also often uttered when the deer is alarmed, when it hears any loud or unusual sound, or suspects the existence of any danger. Occasionally a kakar will continue to bark, at short intervals, for an hour at a time, and advantage may be taken of his betraying his whereabouts to stalk him.

Kakar are adepts at making their way at speed through the most dense jungle, and run with their head low and their hind-quarters elevated. When running, a peculiar rattling sound is produced by these animals, which is thought to originate in the mouth, although in what manner is still unknown. The bucks, when attacked by dogs, appear to use their tusks, which curve outwards in a peculiar manner, as their chief weapons of defence, and are able with them to inflict gashes of considerable depth. Although young kakar are apparently to be met with at all seasons of the year, the chief pairing-time in Northern India is during the months of January and February; the fawns, which may be one or two in number, being born in the following June or July. The bucks shed their antlers in May, and their renewal is completed by August. The venison of the kakar is considered superior to that of most of the Indian deer.

HEAD OF HAIRY-FRONTED MUNTJAC.
(From Sclater, *Proc. Zool. Soc.*, 1885.)

Hunting. In regard to the sport afforded by these deer, General Kinloch writes: "I have stalked and shot kakar at various times, and have also had them driven out of cover; many may be found in this manner, but, unless one knows their usual runs, it is difficult to know where to post oneself. Like many other animals, the kakar objects to being driven, and will break back through the beaters in order to make his point. As they probably only give a chance of a snap-shot at short range, it is easier to kill them with a charge of shot than with a rifle-bullet."

Other Species. There are four other species of muntjac, in addition to the common Indian form. Of these, Fea's muntjac (*C. feæ*), from Tenasserim, is rather smaller and darker than the Indian species, with a short tuft of hair between the antlers, and a much shorter tail; the latter appendage being altogether white, save for a narrow streak of black down the middle of its upper surface.

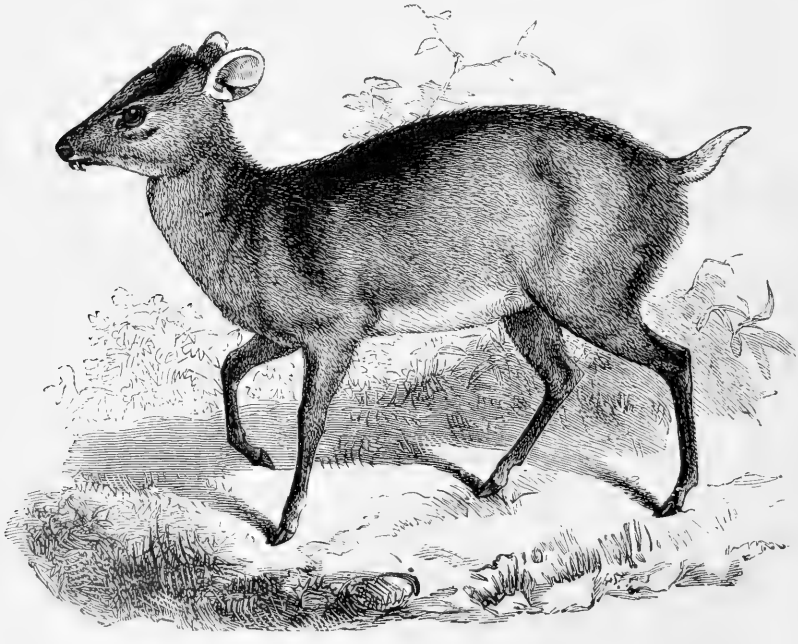
The other three species are Chinese. In Eastern Tibet and the neighbourhood of Hangchow there occurs Sclater's muntjac (*C. lacrymans*), characterised by the bright yellowish-coloured hair of the head and neck, while that clothing the body and limbs is of a much more sombre hue. The smallest member of the group is Reeves's muntjac (*C. reevesi*), from Southern China and Formosa, in which the colour of the whole fur is brighter than in any other species, while the pedicles of the antlers diverge less from one another, and the hollow in the skull for the gland below the eye is of unusually large size.

Finally, the hairy-fronted muntjac (*C. crinifrons*), which is perhaps the handsomest of all and comes from the neighbourhood of Ningpo, is distinguished at a glance by the long tuft of hair on the forehead and top of the head, in which the minute antlers are almost entirely hidden. This species stands about 24 inches in height at the shoulder; and the general colour of its fur is brown. The upper part of the head is, however, of a bright chestnut, which, with the white of the under-parts and lower surface of the tail, forms a striking contrast to the sombre coloration of the body.

The Tufted Deer.

Genus *Elaphodus*.

Nearly related to the muntjacs are two small deer from Chinese territory, of which the one known as Michie's deer (*Elaphodus michianus*) inhabits Eastern



MICHIE'S DEER. (From Sclater, *Proc. Zool. Soc.*, 1876.)

China, while the other, which may be called the Tibetan tufted deer (*E. cephalophus*), is from Moupin, in Eastern Tibet. In the males of these deer, as represented in the

accompanying illustration, the antlers are extremely minute and unbranched, while their supports take the form of long pedicles, which, instead of diverging as in the muntjacs, are convergent. Then, again, the rib-like ridges occurring on the face of the muntjacs are absent, as are likewise some small glands found on the forehead of the latter. Like the muntjacs, the bucks of these two deer are furnished with long tusks in the upper jaw, although their extremities are not turned outwards. In both species the hair is so coarse as to have been compared to small quills; and on the forehead the hair is lengthened so as to form a kind of horseshoe-like crest on the tuft.

In Michie's deer the general colour of the fur is greyish black, each individual hair being white for a considerable distance above its base, and the face and neck uniformly dark grey; while the crest on the forehead and portions of the ears are dark brown. In the Tibetan tufted deer the fur on the head, neck, and fore-quarters is dark brown, each hair being brown above and whitish beneath, while a pure white ring divides the two colours; consequently there is a speckled appearance in the fur of the anterior part of the animal. In the hinder part of the body the white rings on the hairs are absent, and the colour of the fur is consequently uniform dark brown, becoming of a still deeper shade on the feet and the crest on the forehead. The ears have a transverse black bar, with white tips and edges; the under-parts of the body and the lower surface of the tail being likewise white.

Michie's deer is abundant in the reeds bordering the rivers in the neighbourhood of Ningpo and other parts of Eastern China.

The Reindeer.

Genus *Rangifer.*

The reindeer (*Rangifer tarandus*) differs from all other members of the deer-tribe in that the antlers are not borne only by the male, although those of the female are of smaller dimensions; and together with all the deer remaining for notice, it differs from those already described in the structure of the fore-foot. In these, which, with the single exception of the wapiti, are Old World types, the lateral metacarpal bones of the fore-foot, which originally supported the lateral toes, are represented only by two small splints lying on either side of the upper end of the cannon-bone, as shown in the foot of the sheep on p. 370. On the other hand, in the reindeer and the under-mentioned genera, these same lateral metacarpal bones are represented only by their lower extremities, and thus still support the toe-bones of the lateral hoofs, as shown in the figure on the next page. This difference may not, perhaps, appear to be of much significance, but as there are other indications of affinity between the members of the two groups into which the deer family is thereby divided, it is probably of considerable importance in classification. The majority of the deer belonging to the present group are either common to the northern regions of both hemispheres, or are restricted to the New World, the roe and the Chinese water-deer being the only exclusively Old World forms.

Reverting to the consideration of the reindeer, we have first to observe that in addition to the presence of antlers in both sexes, the genus is distinguished from

all other deer by the form and position of these appendages. Thus instead of being placed low down on the forehead, the antlers take their origin on the upper part of the skull, immediately over the occipital ridge, and are accordingly far behind the eyes; while as regards form they are distinguished by the great development of the brow-tines in the males, which are more or less laterally compressed, branched, and palmated, and descend to a greater or less degree over the face, so that their lower edge sometimes almost touches the nose. Then, again, there is such an amount of individual variation that scarcely any two reindeer can be found in which the antlers are precisely similar; while frequently the two antlers of the same individual are widely different from one another.

THE BONES OF THE LEFT FORE-FOOT OF THE ROEBUCK. (From Dawkins.)

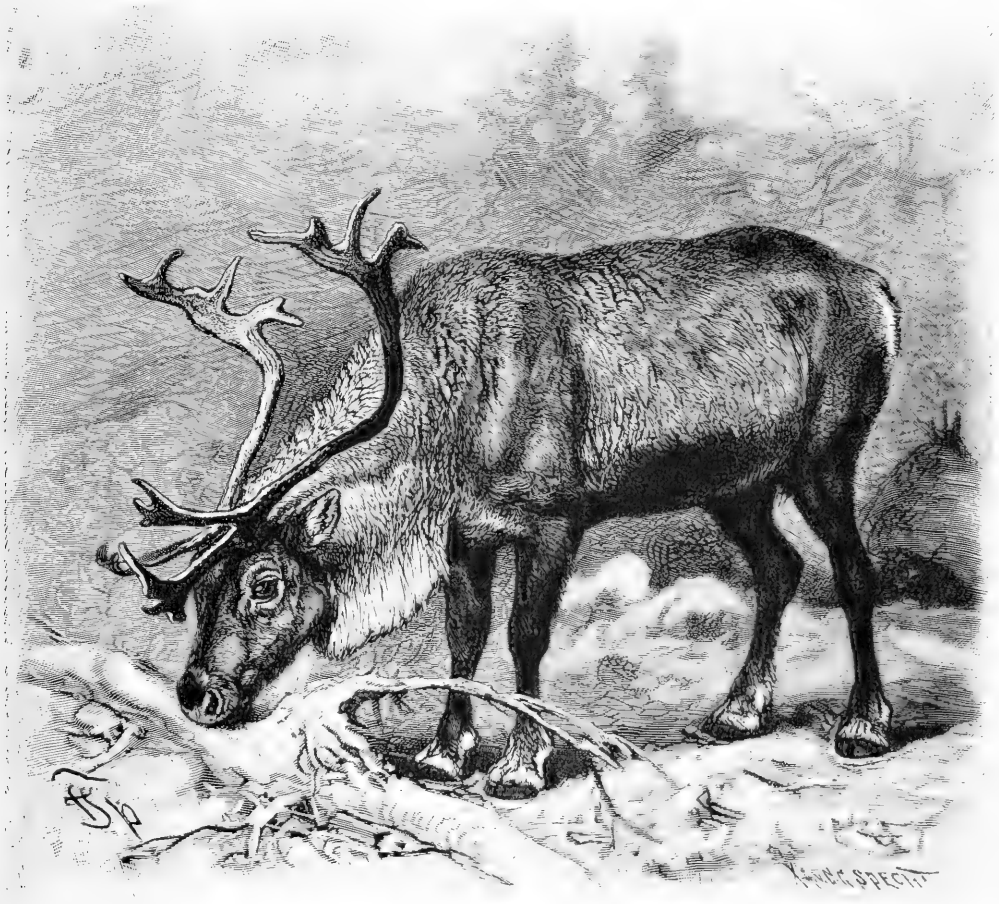
The antlers are very long in proportion to the length of the skull, and above the brow-tine, which is also branched and often palmated, after giving off the bez-tine, the narrow beam is continued backwards for some distance, till it bends forward at an angle, usually giving off a small back-tine at the bend. The beam is then continued upwards and forwards till it becomes palmated near the extremity, with a variable number of points on its hinder border. In the reindeer of the New World the antlers exhibit the greatest complexity of structure, the brow-tine of one side becoming enormously developed and greatly palmated, while on the other it is aborted.

In build the reindeer is a somewhat heavy animal, with short and rather stout limbs, terminating in large hoofs. The main pair of hoofs, as shown in our figure, are rounded, broad and short, with the intervening cleft very deep and wide; while the lateral hoofs are unusually large and flattened from front to back. In traversing snowfields the two main hoofs spread out sideways, while the lateral pair come in contact with the snow, by which means a large extent of surface is afforded to support the weight. The muzzle of the reindeer differs from that of all the deer hitherto mentioned in being clothed with soft hairs of moderate length. The neck has no distinct mane, but the throat is fringed with long and rather stiff hair. The ears are smaller than in any other deer, and thickly covered on both sides with hair. The hair clothing the body is from an inch to an inch and a half in length, and is somewhat crimped or waved, while beneath this is a coat of woolly under-fur. The general colour of the reindeer is brownish grey, with the face, neck, and throat whitish, and the nose, ears, and limbs brown. There are, however, great individual variations as regards colour, some specimens being nearly or quite white throughout. In general the tail is white, with a tinge of brown at the root and on the upper surface; and there is a distinct white ring round each fetlock. The hoofs are black, and the antlers

UNDER SURFACE OF FOOT OF REINDEER.

yellowish, wearing white in places. Reindeer fawns are uniformly coloured like the adult.

The various races of reindeer differ considerably from one another in respect of height; but the bucks of the larger American variety stand about $4\frac{1}{2}$ feet at the withers, and usually weigh some 350 lbs., although unusually fine specimens may reach nearly 400 lbs. In regard to the length of the antlers, it appears that fine examples vary from 48 to just over 57 inches, although one pair is known in which



REINDEER ($\frac{1}{15}$ nat. size).

the length reaches to upwards of 60 inches. There is great variation in regard to the span of antlers, and the number of points they carry; while it is not unfrequently the case that the longest specimens have by no means the greatest girth.

Distribution. Reindeer inhabit the northern regions of both the Eastern and Western Hemispheres, and English zoologists are pretty generally agreed that there is but a single species. In America, however, where they are known by the French-Canadian name caribou (a corruption of *carrebœuf*, literally "square-ox"), it is considered that there are either one or two species distinct from the Old World form. Thus, whereas Mr. Caton regards the smaller North

American form, known as the barren-ground caribou, as a distinct species, while he identifies the larger southern kind termed the woodland caribou with *R. tarandus*, other writers, like Dr. Hart Merriam, consider that both the American forms are entitled to rank as distinct species. We shall, however, follow the view that all kinds of reindeer are merely local varieties or races of a single widely spread species.

In the Old World reindeer are found nearly as far north as the extreme limits of land, while they extend from Scandinavia in the west to Eastern Siberia. In the Ural region their southern limit reaches in the Kirghiz steppes to about the 52nd parallel of north latitude, and they are still to be met with in the wild state, in the neighbourhood of Orenburg. In European Russia they are found in the forests of the Government of Kazan as far south as latitude 54°; and it is stated that in this district they attain very large dimensions, while the females are without antlers. In Scandinavia wild reindeer are, however, now becoming rare. Domesticated reindeer are kept in Siberia, Lapland, and part of Norway, as well as in the northern districts of the Government of Perm, but appear to be unknown in the Orenburg region. They were introduced into Iceland in 1870, where they flourish well, and in 1892 sixteen head were landed in Alaska. The Scandinavian domesticated breed, which is chiefly used by the Laps for purposes of draught, is considerably smaller than the wild race; but in Siberia there is a tamed breed of larger size, mainly used for riding. The importance of the reindeer to the Laplander has been so often written of that we may be excused for making any further mention of it.

In regard to the northern extension of the Old World reindeer, Baron Nordenskiöld observes that although it has not been found in Francis Joseph Land, it occurs at Cape Chelyuskin, as well as in Novaia Zemlia and Spitzbergen, and in the still more northerly Phipps and Parry Islands, which lie between the 80th and 81st parallels of north latitude. In some of these desolate regions reindeer are still very numerous, even where, as in Spitzbergen, they are incessantly hunted. Regarding their abundance in the islands last-named, Baron Nordenskiöld says that it has been suggested that they immigrate from Novaia Zemlia; but he considers it more probable that if such an immigration does take place, it must be from some unknown Arctic land to the north-north-east.

The same writer observes that "the life of the wild reindeer is best known in Spitzbergen. During the summer it betakes itself to the grassy plains in the ice-free valleys of the island; in late autumn it withdraws—according to the walrus-hunter's statements—to the sea-coast, in order to eat the seaweed that is thrown up on the beach. In winter it goes back to the lichen-clad mountain heights in the interior of the country, where it appears to thrive exceedingly well, though the cold during winter must be excessively severe; for when the reindeer in spring return to the coast they are still very fat, but some weeks afterwards, when the snow has frozen on the surface, and a crust of ice makes it difficult for them to get at the mountain-sides, they become so poor as to be scarcely eatable. In summer, however, they speedily eat themselves back into condition, and in autumn they are so fat that they would certainly take prizes at an exhibition of fat cattle."

Further observations on the mode of life of the reindeer will be deferred till we

come to the American varieties, but it is important that the periodical migrations of these animals which take place in Siberia should be noticed here. Admiral von Wrangel, when in Eastern Siberia, had an opportunity of seeing such migrations on more than one occasion; and he relates that the moving masses might be reckoned to include thousands of individuals, split up into herds of two or three hundred head. On one of these occasions the Admiral states that "two large migrating bodies of reindeer passed at no great distance. They were descending the hills from the north-west, and crossing the plain on their way to the forests, where they spend the winter. Both bodies of deer extended further than the eye could reach, and formed a compact mass narrowing to the front. They moved slowly and majestically along, their broad antlers resembling a moving wood of leafless trees. Each body was led by a deer of unusual size, which my guides assured me was always a female."

These southerly winter migrations of the reindeer are of considerable importance in regard to the former occurrence of this animal in Southern Europe; for since its remains are not unfrequently found in association with those of the hippopotamus, we can scarcely assume that in such localities at any rate the climate could have been otherwise than comparatively mild. Accordingly, the most probable hypothesis seems to be that in the Pleistocene period the reindeer, driven by the intense cold of the more northern portions of its habitat, must have travelled so far south during the winter till it reached regions where the rivers were suitable for the habitation of the hippopotamus.

At the present day reindeer are unknown in the Old World to the south of a parallel running a little below the southern shore of the Baltic; it appears, however, that in the time of Cæsar they were met with in the Black Forest of Northern Germany, although whether as permanent residents or as winter immigrants, cannot, of course, be now ascertained. In the British Isles, remains of reindeer are commonly met with in England, Scotland, and Ireland, and it was long considered that in Caithness this deer survived till the middle of the 12th century, although the latest researches tend to discountenance this idea. Reindeer remains are also found over the Continent, occurring as far south as the valleys of the Dordogne and Garonne in France.

Caribou.

Turning now to the American reindeer, which, as aforesaid, are characterised by the great development and palmation of one browtine of the antlers, and the abortion of the other, we find there are two well-marked varieties. The first and smaller of these is the barren-ground caribou, the *R. grœnlandicus* of those who regard it as a distinct species. This reindeer is found only in the barren Arctic districts lying to the northwards of the forest-region of North America. It is abundant in the desolate regions to the northward of Fort Churchill, whence it extends to the confines of the Arctic Ocean. This form, although much inferior in point of size to the woodland caribou, has larger antlers; and it is mainly on the latter ground that American zoologists urge its right to be reckoned as a distinct species. Although confined in summer to the so-called "barren-grounds," this variety of the reindeer makes extensive southerly migrations in autumn, in order to spend the winter in the forest-regions tenanted by the woodland caribou. It appears, however, that even when inhabiting the

same districts, the two races invariably remain completely apart from one another, and show no tendency to intermingle.

Woodland Caribou. The larger woodland caribou, of which the dimensions have already been mentioned, is an inhabitant of the forest districts lying to the south of the barren northern lands. Mr. Lett states that "it inhabits Labrador and Northern Canada, and thence may be found south to Nova Scotia, New Brunswick, and Newfoundland, the northern part of the State of Maine and Lower Canada on both sides of the St. Lawrence, thence westerly in the country north of Quebec to the vicinity of Lake Superior. It never migrates towards the north in summer, as is the habit of the barren-ground caribou, but makes its migration in a southerly direction." This difference in the direction of the migration of the two varieties is certainly very remarkable; and when taken in conjunction with the difference in the size of their antlers, and their refusal to mingle together, indicates their marked distinctness from one another.

Habits. Mr. Caton says, that the woodland caribou feeds on leaves, "grasses, and aquatic plants, but its great resource is lichens. It frequents marshy and swampy grounds more than any other of the Deer family; for which it is admirably adapted, and where it is well protected from pursuit. In the winter it resorts to the dense forests on higher ground." Like the European variety, the American reindeer is an animal of great endurance and speed, and can trot faster than most horses. In disposition, the caribou is shy and wary, and to ensure a successful stalk requires all the powers of the sportsman. To hunt these animals in deep snow on foot, or on the open ground with dogs, is said to be mere waste of time, as in the one case the animal, by the aid of its broad hoofs, makes its way over the snow without difficulty, while in the other it easily distances and tires out its pursuers.

Woodland caribou migrate in herds of from one hundred to two hundred, or even as many as five hundred head. During these periodical migrations, Mr. Lett says that "they are easily killed in vast numbers by taking advantage of the wind, and shooting them as they pass along. They are also frequently surprised crossing rivers or lakes that intersect their line of march, when they become an easy prey to hunters in canoes. In winter they are often seen upon the ice on inland lakes. On such occasions they can be easily shot, provided they neither see nor smell the hunter. The instant, however, they catch the scent of their hidden foe, they vanish like a streak of light. I have heard it said by those who have seen them scudding over the ice, like shadows, that in an incredibly short space of time they appeared to the naked eye not larger than rabbits." Indeed, so swift are they on the ice, that when caribou once set foot on it, the hunter who knows his business immediately gives up the pursuit as hopeless. Solitary caribou are more wary, and consequently more difficult to stalk, than those in a herd.

The time when caribou are most easily killed is during the months of March and April, the snow having then a thin cake of ice on the surface, through which the animals are constantly breaking, and are thus run down without much difficulty by hunters on snow-shoes.

There appears to be a lack of information as to the breeding-habits both of

the caribou and of the wild reindeer of the Old World. The pairing-season of the barren-ground caribou is, however, said to be in the winter; while that of the woodland variety is in September. In the case of the latter, the antlers of the bucks are shed in December, while those of the does do not fall until the spring. The fawns are produced in May, and are either one or two in number.

Owing to incessant pursuit, in season and out of season, the numbers of the caribou have been greatly reduced in many districts; but, in Newfoundland, these animals are now protected by special laws.

The Elk or Moose.

Genus *Alces*.

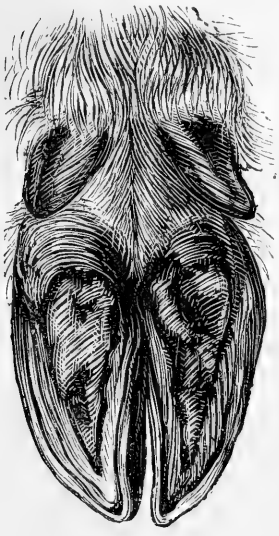
The largest living representative of the Deer family is the somewhat ungainly-looking animal known in Europe as the elk, and in North America as the moose (*Alces machlis*). This fine animal differs from all other deer in the form and setting-on of the antlers of the male; and it is not improbable that these appendages have really no connection with those of the true deer, but were independently acquired.

In build, the elk is characterised by the length of its limbs, its short neck, very long and flapping ears, and the great length and narrowness of the head, which terminates in a broad overhanging muzzle, completely covered with short fine hair, save for a small triangular spot just below the nostrils. The extremity of the muzzle is flexible, and the eyes are small and sunken. The antlers, instead of emerging from the forehead at an acute angle with its middle line and inclining forwards, as is the case with all living representatives of the genus *Cervus*, project on either side at right angles to the middle line of the forehead, and in the same plane as its surface. Their basal portion consists of a short, cylindrical beam, without any tine, and beyond this beam they expand into an enormous basin-like palmation. In young animals, and more especially in the Swedish elk, the antlers have their palmated portion divided into a smaller anterior and a larger posterior moiety; but in the adult of the American form these two coalesce into a single palmation, elongated from back to front, and containing a number of short and irregular snags on its outer edge. The antlers of fine specimens may weigh as much as 60 lbs.; and in a head in the possession of Mr. Otho Shaw the antlers have a span of 65 inches, a length along the palmation of 41 inches, and a width across the same of 24 inches, but a span of 66 inches is on record. The antlers do not attain their full dimensions till the animal has attained its ninth year.

The skull of the elk differs from that of other deer in the extreme shortness of the nasal bones, and the consequently very large size of the cavity of the nose. The upper molar teeth have very low and broad crowns. The tail is so short that it is scarcely more than a rudiment.

The elk carries its short neck nearly horizontally, and therefore somewhat lower than the elevated withers; and it is this feature which so largely contributes to the ungainly and ugly appearance of the animal. The feet have long and

sharply-pointed hoofs, very different in appearance from those of the reindeer; and the lateral hoofs are relatively large and loosely attached. In the male the hair is long, coarse, and somewhat brittle, and is elongated into a slight mane on the neck, shoulders, and throat; while in colour it varies from very dark brown to yellowish grey. The female is lighter coloured than the male during the winter season. In both sexes the hair is softer and finer in the summer than in the winter; and during the later season an abundant supply of woolly under-fur is developed. Young animals have also brighter-coloured and sleeker coats than aged individuals; and in the latter the fading of the winter coat with the advance of spring is much more noticeable than in the former. The fawns are uniformly coloured like the adults.



UNDER SURFACE OF FOOT OF ELK.

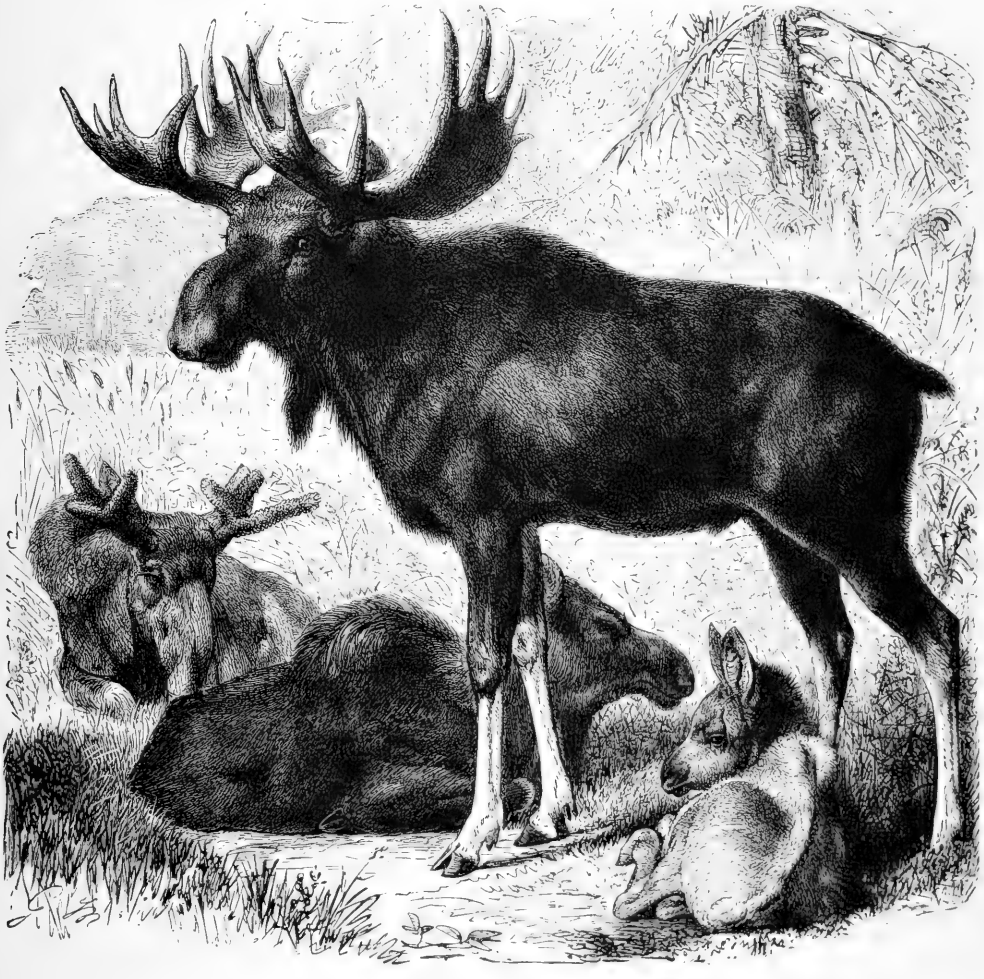
Dimensions. The height of the elk has been much exaggerated, some writers asserting that the male may stand as much as 8 feet at the withers. Mr. Caton observes, however, that it is safe to say that it may attain a height of 6 feet, or occasionally rather more, and we may probably put the extreme limits as not exceeding $6\frac{1}{2}$ feet. The weight of an average adult male elk is given by the writer last cited as 700 lbs., but large specimens will reach 900 or 1000, and, it is said, even as much as 1200 lbs.

Adult male elk, and occasionally the females, have a curious pendulous appendage on the throat formed by a dilatation of the skin, and covered with long and coarse blackish hairs. This appendage may vary in length from 4 to 10 inches, and is known to the American hunters as the bell; its use is unknown.

Distribution. The elk has a distribution very nearly the same as that of the reindeer, although it does not extend so far north, and is, indeed, limited by the northern extension of trees, being essentially a forest animal. In Europe, although now greatly diminished in numbers, it is found locally in Scandinavia, Eastern Prussia, Lithuania, and parts of Russia, such as the neighbourhood of Orenburg, the government forest near Moscow, and the districts bordering the river Samara in Astrakhan. Thence it extends eastwards into the subarctic portions of Siberia, although its extreme limits in this direction are not fully ascertained. A few years ago an elk was shot in Galicia, which had probably wandered from more northern latitudes. In the time of Pallas, elk were also found on the northern slopes of the Caucasus; while Cæsar mentions them as inhabiting the Black Forest. During the prehistoric period, their distribution was still more extensive in Europe; and their remains have been found in many parts of England, the most southern point being Walthamstow in Essex. In the still earlier deposits of the Norfolk forest-bed, the species was preceded by the broad-fronted elk (*A. latifrons*).

In North America the range of the elk appears to have extended originally from about the 43rd to the 70th parallel of latitude, its northern limit being marked by the southern border of the so-called barren grounds. Mr. Caton says

that elk have been seen as far south as the Ohio, and as far north as the Mackenzie River. Writing in the year 1865, Mr. J. G. Lockhart states that elk were then common over the whole of British America as far north as the barren grounds, although absent from particular localities. Thus they were especially abundant on the west side of the Rocky Mountains, and continued so to Behring Strait, but were unknown on the shores of Hudson Bay in the neighbourhood of York



A FAMILY OF ELK (¼ nat. size.)

Factory. Although specially protected in Ontario, the elk is, however, now rapidly disappearing from the forests of North America; and this is not to be wondered at, when we learn that some years ago several hundreds of these animals were shot on one occasion in New Brunswick merely for the sake of their hides; their carcases being left to rot on the ground. Elk are still comparatively common in Alaska, but have more or less completely disappeared from certain districts where they were formerly abundant. As far back as 1881, Mr. Caton wrote, that "they have probably entirely ceased their visits to Newfoundland; but

in Labrador many still remain, though gradually retreating thence towards the more secluded and inaccessible portions of the country. From Upper Canada all are gone, and but few remain in Lower Canada, where, fifty years since, they were abundant. What are left have retreated to the great dense forests of the north."

Habits.

Elk feed more upon the leaves and twigs of trees than upon grass; and their length of limb enables them to pluck such nutriment with facility, while the shortness of their necks renders them unfitted for grazing, unless in places where the grass is unusually tall, when they merely pluck the tops. In Northern Europe and Asia birch, willows, aspens, and poplars afford a large proportion of the leafy food of the elk; but in North America both evergreen and deciduous trees contribute their quota. Various lichens and mosses are, however, also eaten; but in winter, when the whole country is deeply buried in snow, the elk have to depend solely on twigs and buds of trees. In order to obtain the foliage of saplings which are above their reach, elk in America, at least, have a curious habit of straddling on either side of the stem with their fore-legs, and then gradually pressing down the tree with the weight of their body.

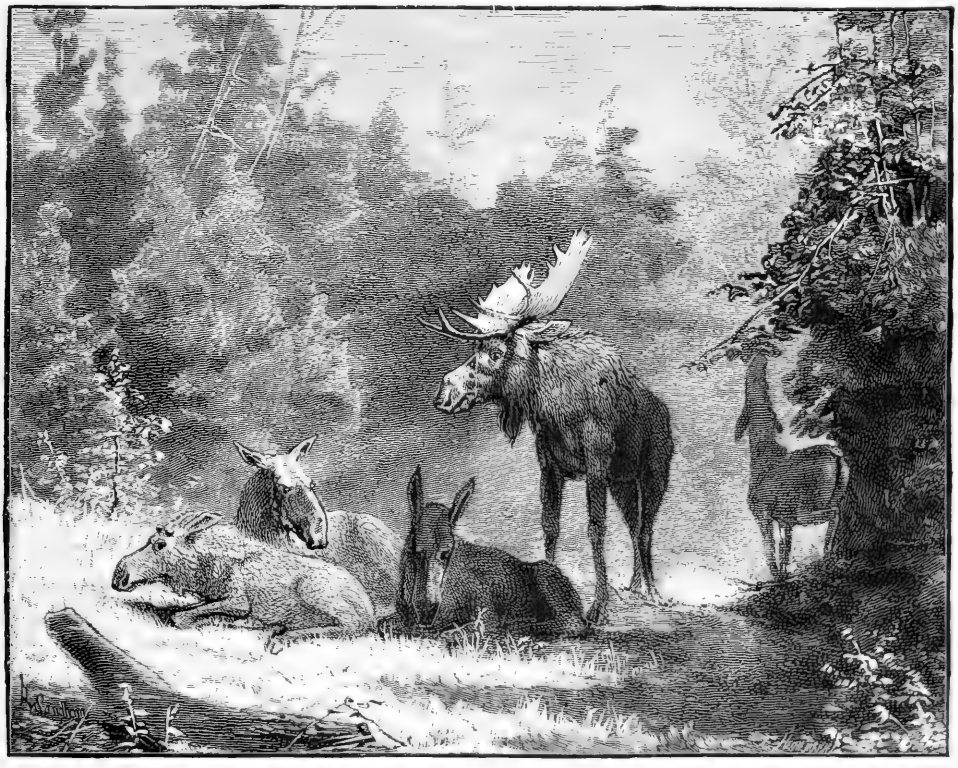
In America elk commence feeding with the first signs of dawn, and continue till sunrise, after which they repose or ruminate till ten or eleven o'clock. From that time they again feed till about two, when they take another period of repose till four or five, and then feed till dusk, when they lie down for the night. Mr. Lockhart says that elk "generally lie down with their tails to windward, trusting to their senses of hearing and smelling, which are remarkably acute, to warn them of approaching danger from that quarter. They can use their eyes to warn them from danger to leeward, where hearing, and especially smelling, would be of little use. While sleeping or chewing the cud, their ears are in perpetual motion, one backward, the other forward, alternately. They also have the remarkable instinct to make a short turn and sleep below the wind of their fresh track, so that any one falling thereon and following it up is sure to be heard or smelt before he can get within shooting distance."

In summer the favourite resorts of the American elk are in the neighbourhood of swamps, rivers, or lakes, where long grasses which can be easily reached grow in rank abundance. In winter, however, they generally betake themselves to higher grounds, although always those clothed with dense and almost impenetrable forest. When disturbed, the elk, in spite of his great bulk, makes off with extreme rapidity and almost perfect silence, even in the thickest cover, always when possible selecting moss-clad and yielding ground over which to make its way.

In winter, elk in America are in the habit of consorting in small parties, often comprising a male, female, and the young of two seasons, and taking up their quarters in what is termed a moose-yard. "The yard," writes Mr. C. C. Ward, "is situated in some part of the country where there is an abundant growth of young deciduous trees, such as the white birch, poplars, maple, and mountain-ash; these, together with a few of the coniferous trees, the balsam-fir and juniper, form the staple diet of the moose. Some writers maintain that the bull moose never yards with the female and young, but this is disproved by my own experience as a moose-hunter. . . . I have on many occasions found and killed males occupying the same

yard with the old and young females." It appears, however, that very old males generally make a yard for themselves, and remain alone throughout the winter.

The antlers of the adult elk are shed in America during January, and the new pair attain their full development in August. During the time that the antlers have been in the velvet, the male elk has spent most of his time in the marshes and swamps, feeding on the leaves of the yellow water-lily, and frequently protecting himself from the attacks of mosquitoes and other insect torments by standing neck-deep in the water. With the complete development of his antlers, he sallies forth from these retreats to commence calling, and to enter upon a series of com-



A MOOSE-YARD.

bats with his rivals for the possession of the females. These contests appear to be fully as fierce and determined as those of the red deer; and Mr. Ward records finding in a lake the skulls of two elk, with their antlers inextricably interlocked, which had evidently perished after one of these encounters. The fawns are born in the following May, and are either one or two, or, very exceptionally, three in number. They are of a dark fawn-colour, but, according to Mr. Ward, with a slight dappling. The females, before the birth of the fawns, seek out the most sequestered spots, such as islands in lakes and rivers, and swamps and prairies, which are liable to be overflowed at certain seasons of the year, where they will most likely be free from the attacks of wolves and bears. Some writers aver that at such seasons they likewise endeavour to avoid the males, but this is denied by

Mr. Ward, who believes that the male is never very far away from his consort. Mr. Lockhart says that when the fawns are very young and helpless, "the mother in their defence will even attack man. At such times her appearance reminds one forcibly of a vicious horse. She raises her head, throws back her ears upon her neck, and sniffs or blows like a horse; then she bounds towards her enemy, striking the ground with her fore-feet, and her eyes glittering with rage."

The favourite pace of the elk when in rapid motion is a long swinging trot; and it is said that so long as the animal keeps to this pace it cannot be overtaken by any ordinary horse. If, however, it can be forced into a gallop, the elk soon becomes blown, and can then be readily ridden down.

We have already alluded to the ungainly appearance of the elk; and this ungainliness is certainly most strongly marked in specimens exhibited alive in menageries or mounted in museums. Mr. Ward states, however, that when seen among his native forests no one can fail to be impressed with the majesty and grandeur of the male elk in all the glory of his spreading antlers.

Hunting.

In Sweden and Norway elk are either hunted by being driven or stalked. In the autumn of 1885 the elk in the forest of Huneberg, which had been preserved for thirty-five years, were hunted by a royal party, when fifty-one head were shot; and in 1888 upwards of sixty-six were killed in the same forest. In America there are now three legitimate methods of elk-hunting, namely, stalking or still-hunting, fire-hunting, and calling; the wholesale slaughter of the animals when imprisoned in their yards by the snows of winter having fortunately been prohibited by the legislature. In the "Far West," the best season for elk-hunting is during the months of October and November; the first snowfalls occurring in the mountains during the latter month, and the males being then incessantly calling or fighting with their fellows. To be successful in elk-stalking requires the aid of an experienced Indian guide, as very few men of European descent can attain that marvellous skill in tracking which appears to come naturally to the Indian.

It appears to be only in the north-eastern districts that the practice of calling with a birch-bark pipe is followed, as the custom is said to be quite unknown in the Rocky Mountains. In regard to the mode of procedure, Mr. Ward says that "the Indian, having selected a favourable position for his purpose, generally on the margin of a lake, heath, or bog, where he can readily conceal himself, puts his birchen trumpet to his mouth, and gives the call of the cow moose in a manner so startling and truthful that only the educated ear of an Indian could detect the counterfeit. If the call is successful, presently the responsive bull moose is heard crashing through the forest, uttering his blood-curdling bellow or roar, and rattling his antlers against the trees in challenge to all rivals." In other districts the call of the male is imitated by drawing the shoulder-bone of a moose against the dry bark of a young tree, and any male that may be in the neighbourhood advances to answer the challenge of the supposed rival. In the Rocky Mountains the male moose instead of uttering the bellowing call mentioned above, only gives vent to a loud and prolonged kind of whistle, while the female is completely silent.

Fire-hunting, or hunting by torchlight, is practised, says Mr. Ward, by exhibiting a bright light, formed by burning bunches of birch-bark in places known

to be frequented by moose. The brilliant light seems to fascinate the animal, and he will readily approach within range of the rifle. The torch placed in the bow of a canoe is also used as a lure on a lake or a river, but is attended with considerable danger, as a wounded or enraged moose will not unfrequently upset the canoe.

A favourite mode of moose-hunting, when the snow lay very deep on the ground, was by running them down in snow-shoes. Accidents were, however, frequent in this kind of hunting, more especially during the spring, when the snow is covered with a thin crust. At such times, if the hunter happened incautiously to run too near the moose, the animal would turn suddenly, and leaping upon his pursuer trample him under foot. Mr. Lockhart also says that in British America the Indians during the winter were accustomed in deep snow to make a kind of fence of three poles, tied equidistant from each other, a little taller than a man, stretching perhaps for two days' march between lakes, or a lake and a river, or between two mountains, or in any particular place where the moose were accustomed to pass. Spaces were left vacant here and there in this fence, and in these snares were set, in which the unfortunate animals became entangled.

The flesh of the elk, in spite of some coarseness of grain, is generally regarded as forming excellent venison, although it is said to have a slightly musky taste. The large and fleshy nose is, however, esteemed the greatest delicacy, and is reported by those who have had the opportunity of tasting it to be absolutely unrivalled. Elk manage to maintain themselves in fair condition throughout the winter, so that their flesh is eatable when that of the ordinary American deer is so poor and dry as to be unpalatable.

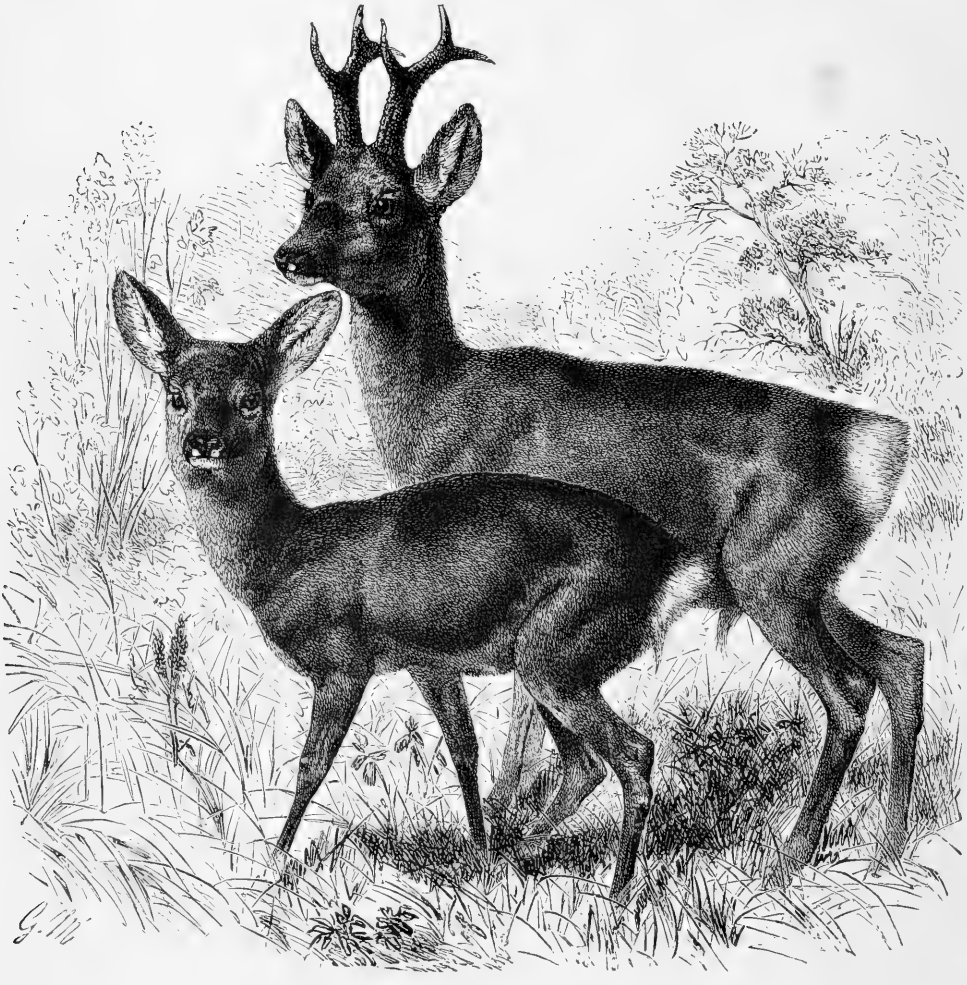
The Roe Deer.

Genus *Capreolus.*

The roe deer (*Capreolus caprea*), while agreeing with the reindeer and the elk in the conformation of the bones of the lower part of the fore-legs, differs entirely from both in the form of its antlers, as well as by its greatly inferior dimensions, being, in fact, one of the smallest representatives of the family. Moreover, whereas the two genera just mentioned have a circumpolar distribution, the roe is strictly confined to the Old World.

The roebuck when fully adult stands about 26 inches in height; and has antlers somewhat less than twice the length of the head. These antlers are rough, and have a straight and nearly cylindrical beam, rising for some distance nearly vertically from the skull, and then giving off one forwardly-directed tine from its front edge; after which the beam curves backwards and terminates in a simple fork. The roe's antler is therefore three-tined like that of the Indian spotted deer, but differs in that instead of having a true brow-tine, the first tine is not given off till about the middle of the entire length. The average length of the antlers is from 8 to 9 inches, but it is said that a pair from Austria have been recorded in which the length was 15 inches. The antlers of the roe are more subject to malformations than those of any other species; and they sometimes show a mass of ill-formed tines.

The roe has a relatively short head, with moderate ears, a very small gland below the eye, and the naked portion of the sharp muzzle small and not extending beyond the nostrils. Normally there are no tusks in the upper jaw; and the tail is short and rudimentary. The neck is rather long and slender, and carried high above the level of the back; and the limbs are likewise slight and delicately formed. In summer the colour of the fur is reddish brown, but in winter, when it becomes



MALE AND FEMALE ROE DEER (1/2 nat. size).

thicker and finer, the tint changes to yellowish grey. There are some black and white markings on the lips, and there is a large patch of white on the buttocks enclosing the tail, while the under-parts and the insides of the limbs are pale yellowish fawn. The fur of the fawns is spotted with white. The weight of a full-grown buck may reach 60 lbs.

Distribution. The common roe is an indigenous inhabitant of the British Isles and the greater part of Europe, extending northwards to the south of Sweden, and southwards to Italy and Spain. In Russia it is confined to the regions

of the Caucasus and the Ukraine, and it extends into Western Asia in Persia. Its fossil remains occur in the superficial deposits of England and the Continent; but at the present day roe deer are found wild within the limits of the British Isles only in Scotland, and in the neighbourhood of the Blackmoor Vale, in Dorsetshire, where they were reintroduced in the early part of the century. In the year 1884 a few head were, however, turned out in Epping Forest; and some are kept in certain English parks.

Tartarian Roe. In Turkestan and the mountains separating Russia from China, the place of the ordinary roe is taken by the nearly-allied Tartarian roe (*C. pygargus*), distinguished by its superior size, the more hairy ears, and the larger white patch on the rump. In Mantchuria there is a third form, of small size, and differing somewhat in coloration from both the others.

Habits. In Scotland roe deer are found chiefly in the woods, or on the immediately adjacent moors, but never wander far out on the open hills, although they will venture on to the cultivated lands in search of food. They feed in the early morning and towards evening, and generally associate in small family parties, while they make regular tracks through the woods to their feeding grounds. Their usual food is grass and other herbage, as well as the young shoots of such trees and bushes as they are able to reach. The speed of the roe is not great; but the animal is a great leaper, and, when running, its usual pace is a bounding gallop.

The antlers of the adult bucks are shed about the end of the year, and the new ones are generally fully developed by the latter part of February. The pairing-season takes place during July and August, at which time the bucks are exceedingly pugnacious. Scrope relates that in the summer of 1820 two were found dead in a hollow after one of these contests, lying one on the top of the other, with the antlers of the one firmly driven into the shoulder of the other, and *vice versâ*. The fawns are born in the spring, usually early in May; and in Scotland about one doe out of five or six will produce two fawns at a birth in favourable seasons. No account of the roe would be complete without some reference to the extraordinary fact that although the pairing-season takes place in July or August, and the young are not produced till the following May, yet the period of gestation is only five months. The explanation of this appears to be that the ovum lies dormant for some four and a half months, that is until December, after which it develops in the ordinary manner.

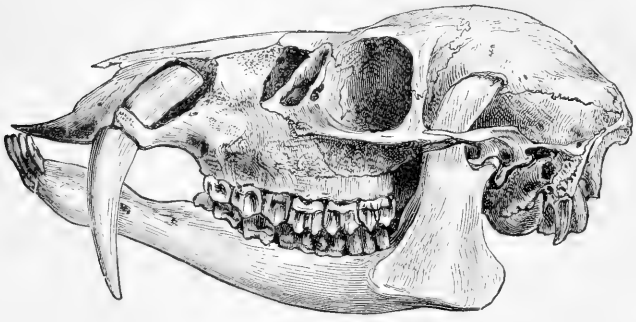
Certain extinct deer found in the Pliocene deposits of the Continent have been considered to belong to the same genus as the roe.

The Chinese Water-Deer.

Genus *Hydropotes*.

Among the tall reeds fringing the banks of the Yang-tse-Kiang, there occur numbers of a small deer differing from any of the species hitherto noticed in that while both sexes are totally devoid of antlers, the males are provided with long scimitar-like tusks in the upper jaw, as shown in the figure on the next page. This

deer is the Chinese water-deer (*Hydropotes inermis*), which in both these features resembles the musk-deer, although in other respects it is allied to the more typical representatives of the present section of the family.



SKULL OF THE CHINESE WATER-DEER WITH PART OF THE UPPER JAW CUT AWAY TO SHOW THE BASE OF THE TUSK. (From Sir V. Brooke, *Proc. Zool. Soc.*, 1872.)

The Chinese water-deer is of the approximate dimensions of the Indian muntjac (p. 366); and is a long-bodied and short-limbed creature, with light reddish-brown fur. One of the most remarkable peculiarities about this small deer is that the does produce from three to six fawns at a birth. The pelage of the young is faintly marked with white spots, arranged in ill-defined rows. The number of young produced, coupled with the absence of antlers in the bucks, indicates that the Chinese water-deer is in all probability a survivor from a very ancient type of the Deer family. These deer are commonly found on the Yang-tse-Kiang, in parties of two or three. When disturbed, they arch their backs and scud away at a great pace in a series of quick leaps. They are usually killed with buckshot.

The resemblance of the skull of the male water-deer to that of the musk-deer, is merely due to both forms being apparently direct descendants of the common ancestral type, from which the more specialised members of the family have been evolved; it being well ascertained that in most or all of the early Tertiary deer the males were devoid of antlers and furnished with long upper tusks. When antlers were developed to their full extent, so as to become efficient weapons of defence, the need for tusks disappeared, and the tusks consequently dwindled or were lost. The muntjacs, in which the antlers are short, present a kind of middle stage of evolution, the tusks having become much smaller than in the Chinese water-deer, though larger than in many species of superior size.

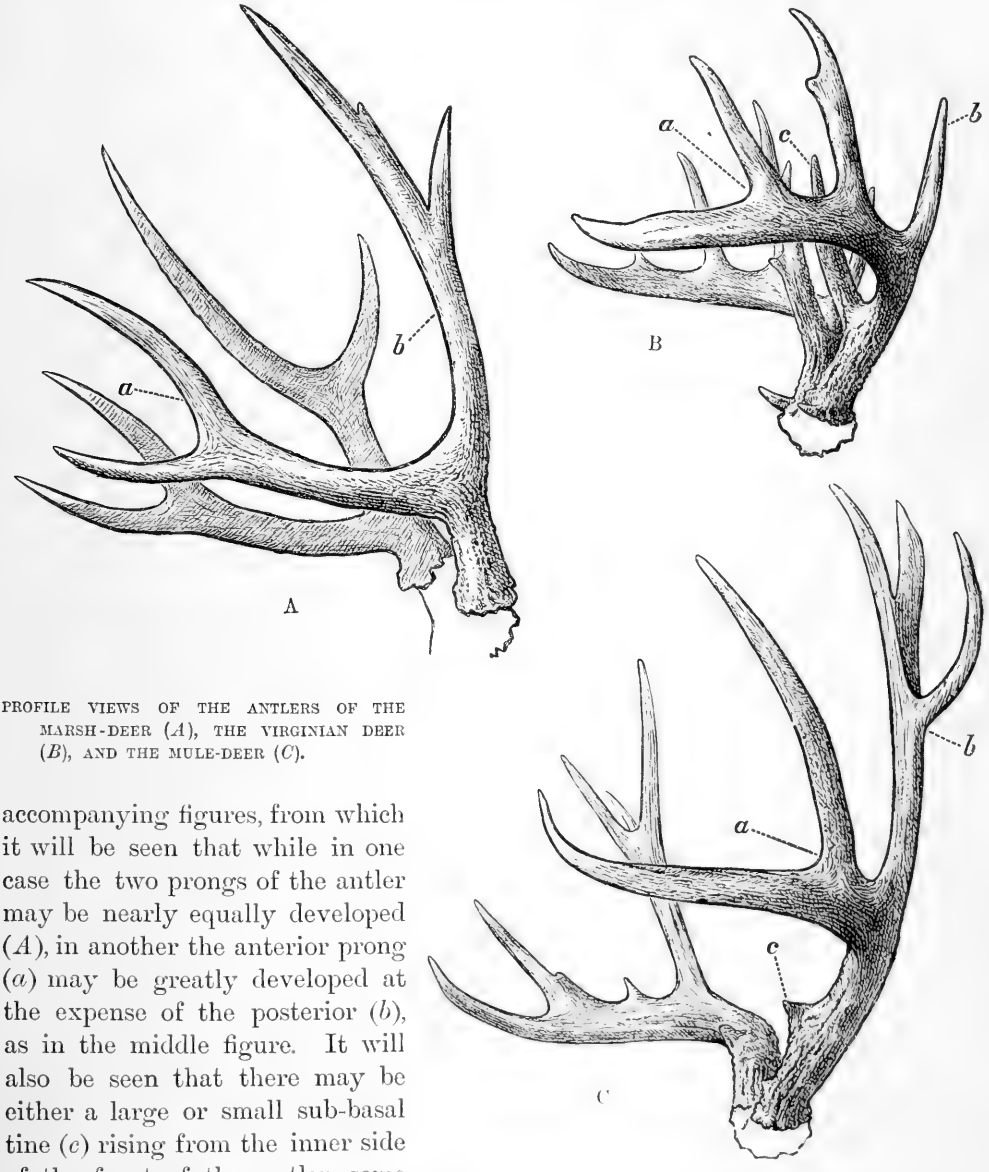
The American Deer.

Genus *Cariacus*.

With the exception of the wapiti, the reindeer, and the elk, which are either closely allied to, or identical with, Old World types, the whole of the deer of America differ essentially from those of Asia and Europe, and are referred (with the exception of one small species which forms a genus by itself) to a totally distinct genus, *Cariacus*.

These deer resemble the reindeer in the structure of the bones of the lower part of the fore-limb; and also in that in the dry skull the aperture of the nasal passage is completely divided by a longitudinal vertical partition of bone. The latter feature is, indeed, peculiar to the reindeer and the American deer, and serves at once to distinguish their skulls from those of any species of the genus *Cervus*.

The American deer are, however, still better distinguished from their Old World cousins, by the characters of their antlers, which are either in the form of simple spikes, or are divided in a fork-like manner, with the anterior prong directed forwards, and no brow-tine. These characteristic features are well shown in the

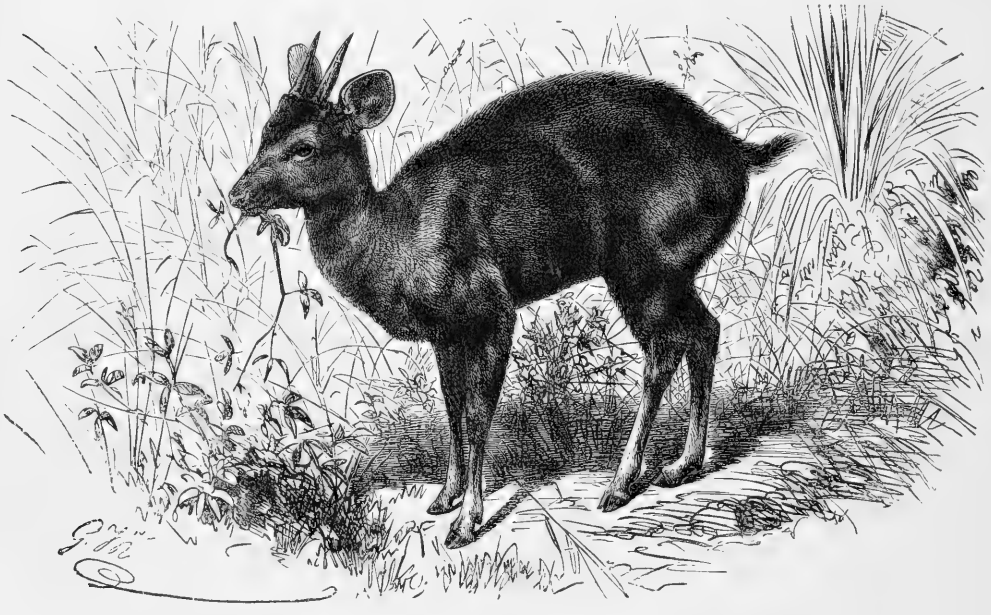


PROFILE VIEWS OF THE ANTLERS OF THE MARSH-DEER (*A*), THE VIRGINIAN DEER (*B*), AND THE MULE-DEER (*C*).

accompanying figures, from which it will be seen that while in one case the two prongs of the antler may be nearly equally developed (*A*), in another the anterior prong (*a*) may be greatly developed at the expense of the posterior (*b*), as in the middle figure. It will also be seen that there may be either a large or small sub-basal tine (*c*) rising from the inner side of the front of the antler, some distance above the burr, and directed upwardly. It was long considered that this sub-basal tine represented the brow-tine of the antlers of the Old World deer, and attempts were made to correlate the other tines of the American deer with those of the genus *Cervus*. Mr. Allan Gordon Cameron has, however, pointed out that this is a totally erroneous notion: the truth being, that while the members of the genus

Cervus have originated in Europe from an early antlerless deer-like creature (*Palæomeryx*), the representatives of *Cariacus* have been independently derived in North America from a totally distinct ancestral deer (*Blastomeryx*), which was likewise unprovided with antlers. And it will accordingly be self-apparent that the antlers of the Old and New World deer are not mutually comparable. Starting from the simple spike-like antlers of the brockets of South America, we shall find that there is a transition through a simply-forked antler to the complex type exhibited by the mule-deer; and it will accordingly be most convenient to commence our notice of these deer with those in which the antlers are simple, and finish with those in which they are most complex.

Before proceeding to the various species, it may, however, be added that all



THE RED BROCKET ($\frac{1}{10}$ nat. size).

the American deer are uniformly coloured above in the adult condition, and that they all have narrow and naked muzzles. The length of the tail is subject to a great amount of specific variation. In addition to the peculiar feature already noticed as distinguishing the hinder aperture of the nasal passage, the skulls of the American deer are characterised by the large dimensions of the unossified space in front of the eye, and the small size of the pit for the reception of the gland.

Brockets. The first group of the American deer is represented by several small species known as brockets, which are confined to the southern half of the continent, and are distinguished by their unbranched spike-like antlers, and by the hair on the middle line of the face radiating in all directions from two points, one of which is situated on the crown of the head, and the other just below the eyes. They are further characterised by the large extent of the naked portion of the muzzle, which completely surrounds the nostrils; and likewise by the spotted coat of the fawns. The tail is of medium length; and the upper jaw may or may

not carry tusks. The best known species is the common red brocket (*C. rufus*)—the one represented in our illustration—of North-Eastern Brazil and Guiana, where it ranges from Surinam to Pernambuco. It is a rather clumsily-built animal, standing 27 inches in height at the withers, and of a uniform reddish brown colour. The nearly allied Brazilian brocket (*C. simplicicornis*), is a rather smaller species, standing only 21 inches in height, and distinguished by its lighter and more elegant shape, as well as by the more decided brown colour of the fur, especially in the young. This species ranges over the greater part of Brazil, and extends westwards into Colombia. The other two species are the Ecuador brocket (*C. rufinus*), found in Ecuador, Colombia, Venezuela, and Guatemala; and the wood-brocket (*C. nemorivagus*), from Surinam and Trinidad, both of which are only 19 inches in height. The former has fur of a full glossy red colour, with the face and legs shaded bluish brown; while the latter differs from all the rest by the pepper-and-salt colour of its hair. Fossil remains of brockets occur in the caverns of Lagoa Santa, in Brazil, which probably belong to species still inhabiting the same districts.

Habits. Brockets are found either alone or in pairs, and never collect in herds; a male and female apparently associating for life. The does produce usually but a single fawn at a birth, in December or January; and the young are able to follow their mother in from three to five days. The speed of the brockets is considerable, but not enduring, and they can be easily ridden down by a good horse, while, when the cover is not too thick, hounds will generally capture them within half an hour.

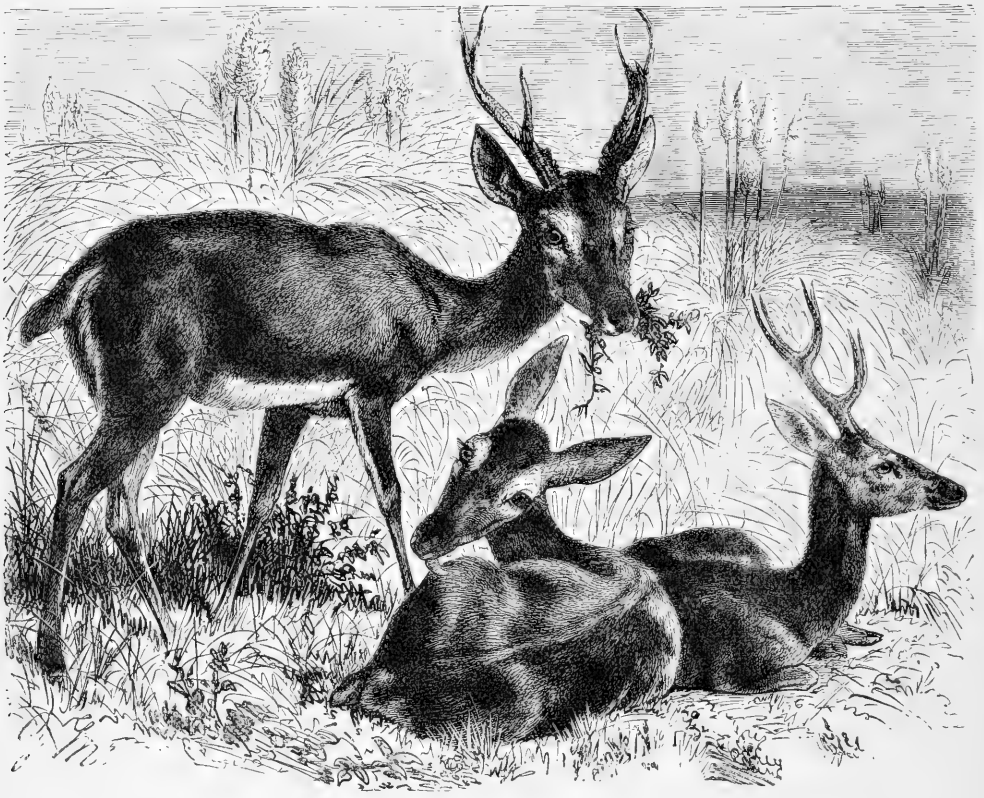
Costa Rica Deer. The Costa Rica deer (*C. clavatus*), of Central America, is another small species with spike-like antlers, which appears to form a group by itself, connecting the brockets with the succeeding groups. This deer is of a uniform reddish yellow colour, like the Virginian deer; and differs from the brockets, and agrees with the following groups in that the hair of the face is directed uniformly backwards, while it likewise resembles those that follow in the smaller size of the naked portion of the muzzle, and in the less arched profile of the face.

Guemals. The third group of the genus is represented by two South American species of medium size, which are confined to the Andes, where they are known as guemals. They are distinguished by the antlers forming a single fork, of which the front prong is the longer, and is projected forwards in the manner characteristic of the genus; by the presence of tusks in the upper jaws of both sexes, and also by the uniform coloration of the fawns. Of the two species, the Chilian guemal (*C. chilensis*) ranges from Santiago to Magellan, but is far more scarce in the northern than the southern portion of this tract; while the Peruvian guemal (*C. antisiensis*) is a northern form from the highlands of Peru.

Pampas Deer. The pampas, or Guazuti deer (*C. campestris*), represented in the illustration on the next page, brings us to a fourth group of the genus, confined to South America, and characterised by the antlers being regularly forked, with the hinder prong—and sometimes also the front one—again forking; while there is no sub-basal snag above the burr. The two species of this group are further characterised by the absence of tusks in the upper jaw, the shortness of the tail, and the uniform coloration of the fawns. They are confined to the eastern

and southern portions of South America; and do not attain such large dimensions as the members of the next group.

The pampas deer is the smaller of the two species, standing about $2\frac{1}{2}$ feet at the shoulder; and its range extends from Paraguay and Uruguay through Argentina into Northern Patagonia. The antlers (as shown in the profile view in our illustration) are characterised by the great development of the forked posterior tine, at the expense of the unbranched front-tine; the number of points thus being three. The hair is thick, coarse, and glossy; its colour on the upper-parts



THE PAMPAS DEER ($\frac{1}{12}$ nat. size).

being light reddish brown. The lower parts of the flanks, as well as the chin, throat, chest, and a stripe on the limbs, are dusky; while the under-parts, inner sides of the limbs, under side and tip of the tail, and insides of the ears are white.

Habits. The pampas deer is the largest and most common ruminant in the districts from which it takes its name. It frequents dry and open parts of the country, and is generally found in pairs or small parties, the old bucks being, however, solitary. Mr. Darwin says that "if a person crawling close along the ground, slowly advances towards a herd, the deer frequently, out of curiosity, approach to reconnoitre him. I have by this means killed, from one spot, three out of the same herd. Although so tame and inquisitive, yet when approached on horseback they are exceedingly wary. In this country nobody

goes on foot, and the deer knows man as its enemy only when he is mounted and armed with the bolas."

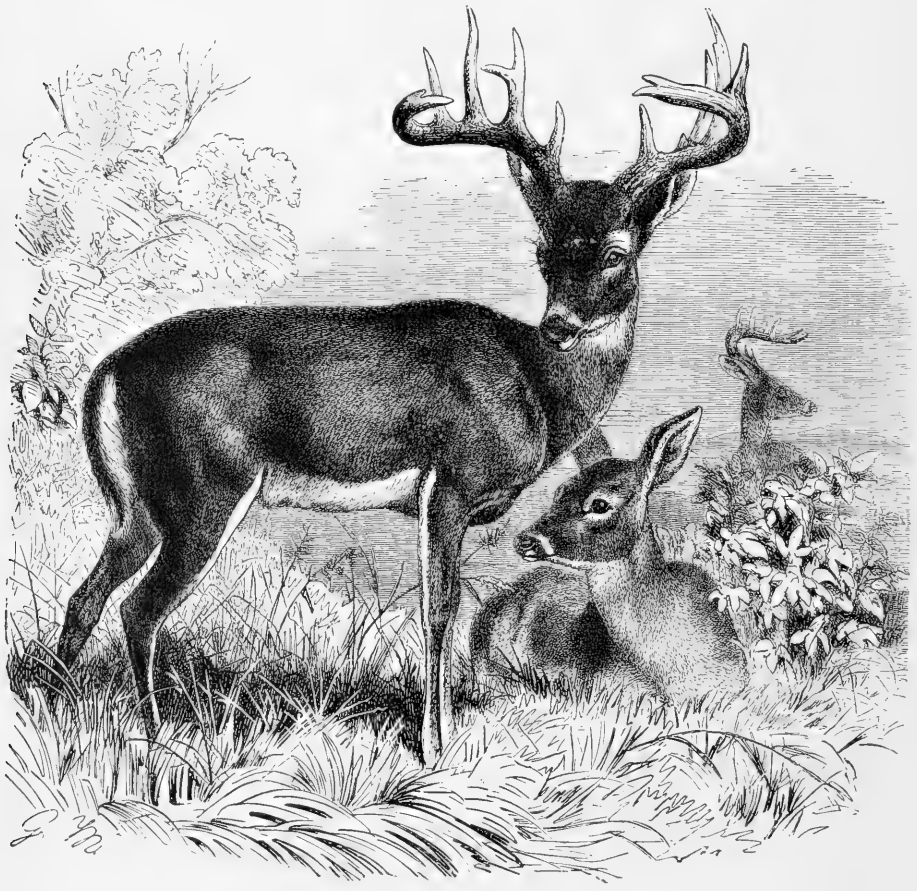
The male of the pampas deer possesses an unpleasant and penetrating effluvium, which, as we can personally attest, can be detected at a distance of several miles. During the day these deer generally lie concealed among the tall pampas-grass, coming out to feed at sunset, and continuing throughout the night. Their speed is very great, and it is only by the very best horses they can be ridden down, while even then, if they have any considerable start, they are pretty sure to escape. The fawns are born in the winter and spring, and it does not appear that there is ever more than one at a birth. Both parents aid in protecting their young, and the doe is especially clever in aiding the escape of her fawn, as the following narrative by Mr. Hudson shows. "When the doe with fawn is approached by a horseman," writes this observer, "even when accompanied by dogs, she stands perfectly motionless, gazing fixedly at the enemy, the fawn motionless at her side; and suddenly, as if at a preconcerted signal, the fawn rushes directly away from her at its utmost speed; and going to a distance of six hundred to a thousand yards conceals itself in a hollow in the ground, or among the long grass, lying down very close with neck stretched out horizontally, and will thus remain until sought by the dam. When very young, if found in its hiding-place, it will allow itself to be taken, making no further effort to escape. After the fawn has run away, the doe still maintains her statuesque attitude, as if resolved to await the onset, and only when the dogs are close to her side she also rushes away, but invariably in a direction as nearly opposite to that taken by the fawn as possible. At first she runs slowly, with a limping gait, and frequently pausing, as if to entice her enemies on; but as they begin to press her more closely, her speed increases, becoming greater the further she succeeds in leading them from the starting-point." The alarm-cry of the pampas deer is a low, whistling bark, but this is never uttered when the doe has a fawn by her side.

Marsh-Deer. The marsh, or guazu deer (*C. palustris*) is a somewhat larger species, found in South Brazil, Paraguay, Rio Grande do Sul, and Uruguay; its westerly range being limited by the Parana River. The antlers of this deer, of which an example is represented in the figure on p. 385, are larger and more complex than those of the pampas-deer, both prongs of the main fork being strongly developed, and each again subdividing; the hinder prong being also generally rather the heavier of the two. In contrast to the pampas-deer, the marsh-deer seeks out swamps and lakes, where it delights to enter the water or wallow in the mud.

Virginian Deer. The last main group of the American deer is typically represented by the well-known Virginian deer (*C. virginianus*), with its numerous varieties, and includes the largest representatives of the genus, as well as the whole of those found in the northern half of the continent. The group is distinguished by the large size and complexity of the antlers, which differ from those of the other groups by the presence of a larger or smaller sub-basal snag (*c* of the figure on p. 385), and likewise by the absence of tusks in the upper jaw, and the spotted coat of the fawns.

The Virginian deer occurs typically in eastern North America, but the so-called

white-tailed deer (*C. leucurus*) of the western side of the continent can scarcely be regarded as anything more than a variety, while it is doubtful if the more southern form known as the Mexican deer (*C. mexicanus*) is really entitled to specific distinction. Considering all these forms as referable to a single species, the Virginian deer will have a range extending right across the American continent from east to west, and from south to north from Canada to Mexico. The main distinctive characteristic of this species is to be found in the antlers (shown in profile



VIRGINIAN DEER ($\frac{1}{15}$ nat. size).

in the figure on p. 385, and from the front in the figure of the entire animal), in which the anterior prong of the main fork shows a great development at the expense of the hinder one. This abortion of the hinder prong is, however, compensated by a corresponding growth of the sub-basal snag. These snags, like the main prongs of the antler, are subject to extraordinary abnormal developments, so that the variations which occur in the antlers of the Virginian deer are only paralleled by those found in the reindeer. The tail is long. The summer pelage of the Virginian deer is a bright bay, from which it derives its common local title of red deer, but in winter the coat becomes of a greyer tinge. At all seasons of the

year the throat, a ring above the muzzle, a spot above and below the eye, portions of the inside of the ear, the inner surfaces of the limbs and the under-parts are, however, white. The upper surface of the tail is dark brown, and even in winter there is a more or less reddish tinge throughout the pelage. In build this deer is the most elegant and graceful of all its compatriots. Its variation in size is so great that it would be useless to give any measurements, although it may be mentioned that unusually fine bucks are said to weigh as much as 200 lbs., and occasionally more.

With regard to the variation in size and colour in this, the commonest North American species, Mr. Caton writes that, although in a given neighbourhood there is a great difference in the size of individuals, in widely different localities there is a permanent and constant difference of size. Thus, whereas in the north all the deer are large, as we proceed south there is a progressive diminution, till in Northern Mexico and the neighbourhood of the Gulf of Mexico the deer have so diminished that it is at first difficult to believe that they are specifically identical with their northern representatives. Similarly we find in the mountainous regions of the west an increase in the amount of white on the tail and body, which has given rise to the notion that the so-called white-tailed deer is a distinct species; but Mr. Caton states that this difference is not constant even among the deer of the west, where many specimens cannot be distinguished from those found in Illinois or Wisconsin. The more northerly race appears, however, to be characterised by the absence of the black markings on the face and tail, which so frequently occur in the southern and eastern portion of the animal's range.

Habits. In the Adirondack region of New York Dr. Hart Merriam says that the Virginian deer "is found high upon the mountain-sides, as well as in the lowest valleys and river-bottoms. It frequents alike the densest and most impenetrable thickets and the open beaver-meadows and frontier clearings. From the 1st of May to the 1st of November its food consists of a great variety of herbs, grasses, marsh and aquatic plants, the leaves of many deciduous trees and shrubs, blueberries, blackberries, other fruits that grow within its reach, and the nutritious beech-nut. While snow covers the ground—which it commonly does about half the year—the fare is necessarily restricted, and it is forced to subsist chiefly upon the twigs and buds of low deciduous trees and shrubs, the twigs and foliage of the arbor vitæ, hemlock, and balsam, and a few mosses and lichens. In winters succeeding a good yield of nuts the mast constitutes its staple article of diet, and is obtained by following the beech ridges and pawing up the snow beneath the trees."

Although shy and timid in the extreme, and at first retreating rapidly before the advance of cultivation, these deer soon regain confidence, and come back to their ancient haunts. Their speed is great, and they are excellent and rapid swimmers, even young fawns while still in the spotted coat taking readily to the water. During long-continued deep snow these deer frequently collect together in parties, sometimes of considerable size, and form "yards," like the elk.

There is considerable variation in the time of changing the grey dress of winter for the red coat of summer, as there is in the date when the antlers of the bucks are shed, these differences being apparently mainly due to the severity or mildness of the winters. The pairing-season, during which the bucks, like those of other deer, are exceedingly pugnacious, lasts from the latter part of October till the beginning

of December. The fawns, which are nearly always two in number, are mostly born in May. They retain their white spots till September, when both young and old assume their winter dress. The fawns are easily tamed, if captured sufficiently young. In bucks of the first year the antlers form unbranched spikes, while in the second year they are simply forked, without any branching of the two prongs, although the sub-basal snag makes its appearance at the same time.

VIRGINIAN DEER SWIMMING.

Hunting. The most legitimate mode of hunting the Virginian deer is by stalking, but in the south they are frequently pursued by hounds, followed by mounted hunters armed with rifles. In other cases hounds are employed to drive the deer to water or down the paths in the woods, where the sportsmen lie in wait. In summer, when deer are abundant, many are killed by what is termed "jacking"; that is to say, a lantern or some other light is carried, upon seeing which the deer becomes dazzled, and, while standing to gaze, offers a ready shot. Finally, "breasting" is employed, according to Mr. G. B. Grinnell, "where the deer make their home among very high grass, such as is to be found on some of the prairies of the south-west or in the great beds of the dry lakes of Northern and Western Nebraska. Here the thick cane-grass stands seven or eight

feet high, and the head of a mounted man is only just visible above the tops. Several huntsmen armed with shot-guns form a line on the leeward side of the space to be hunted over, and ride through it, a little more than a gun-shot apart. The deer that lie in their course are started from the grass, and bound off ahead of the hunters, every now and then showing their backs above the tops of the grass. The horsemen have to shoot from the saddle, and very quickly, to secure their game." Sometimes these deer are shot from canoes as they swim from island to island.

Naked-Eared Deer. The naked-eared deer (*C. gymnotis*) from Colombia and Ecuador appears to be a distinct species, distinguished from the Virginian deer by the large flapping ears, of which the outer surface is naked, by the extreme narrowness of the head, and the more slender form.

Mule-Deer. The most specialised of all the American deer as regards size and complexity of antlers is the mule-deer (*C. macrotis*), so called on account of the enormous size of its ears. In this deer the antlers (as shown in a front view in the accompanying figure, and in profile in the figure on p. 385), when compared with those of the Virginian deer, have recovered the relative importance of the posterior prong, concomitantly with a proportionate reduction of the subbasal snag, and are therefore much more regularly forked "At the same time," writes Mr. A. G. Cameron, "the main strength of the beam is drawn into the anterior prong, and intermediate forms occur both in this and the last-named species, which bridge the gap between the extremes on either side, and leave no doubt as to their intimate relationship." In general the front prong is simply forked, while the second divides into three or more snags in adult bucks; but instances occur where the hinder prong is unbranched, while in some individuals of the Virginian deer the same prong is divided. The antlers of the second year are simply forked, in the third year the hinder prong is also forked; but the forking of the front prong and the development of the subbasal snag does not take place till the assumption of the fourth set of antlers. In the left antler represented in the figure on p. 385, which is from a head in the collection of Mr. A. G. Cameron, the length of the upper prong is 28, and that of the lower prong 29 inches along the curve, the basal girth being $5\frac{3}{4}$ inches; but in the

HEAD OF MULE-DEER.

opposite one the upper prong measures 29 and the lower 27 inches. The extreme span of these antlers is 32 inches. In another head in the same collection the total length of the antlers is 32 inches, with an extreme span of 37 inches. The right antler of this head has an additional tine depending from just below the main fork—an aberration not unfrequently found in the Virginian deer, where it may occur on both sides.

In height the mule-deer is fully equal to the Virginian deer, but it is a more stoutly built and much less graceful animal, with proportionately shorter limbs, while the ears are nearly double the dimensions of those of the latter. The tail is short, and quite unlike that of any other deer, being cylindrical, naked below, and covered above with short white hairs, terminating in a long brush of black ones. In summer the coat of the mule-deer is very thin and sparse, and generally of a reddish colour, with a large white patch on the buttocks; but in winter the general colour is steel-grey, the individual hairs being tipped with black. There is much more white on the face than in the Virginian deer. In a variety from California the colour of the pelage is more decidedly red, and there is a black line running along the middle of the upper surface of the tail.

Habits. Mr. Grinnell states that the mule-deer "is found throughout the greater part of the Missouri River district, and thence westward on the plains, in the Rocky Mountains, and in the Sierra Nevada. It is an inhabitant of rough, broken country, and on the plains is usually only to be found about high buttes, in the bad-lands, or where the country is diversified with rocky ridges, dotted here and there with scattered pines or junipers. Its favourite resorts are the *coulées*, gulches, and cañons which so often break up the high table-lands of the central plateau of the continent; but it is as often to be found among the green valleys high up on the mountain-sides, or, in summer, among the low trees that grow just below the snow-line. It is to such localities as the last-named that the bucks resort during the summer when they are growing their antlers, and when their thin coat of hair affords them little or no protection against the flies."

It appears that the habitat of this deer has not been very much restricted by advancing civilisation, as it is much less alarmed by the invasion of its haunts than is the wapiti. Instead of running in the even manner of the Virginian deer, mule-deer progress by a series of bounds, all their feet leaving the ground simultaneously. For a short distance their pace is rapid, but it soon slackens. As in the case of the Virginian deer, the number of fawns produced at a birth is nearly always two. These are born at the end of May or beginning of June, and retain their spots till September. The pairing-season is in September and October.

By the hunters in Colorado this deer is commonly spoken of as the black-tail, although that name properly belongs to *C. columbianus*.

Black-Tailed Deer. The Columbian black-tailed deer (*C. columbianus*) is a species with a very restricted distribution, being apparently confined to the mountain-ranges bordering the Pacific in the neighbourhood of the Columbia River, and unknown to the eastwards of the Sierra Nevada. This deer is rather smaller than the mule-deer, with relatively smaller ears, but nearly similar antlers. The comparatively short cylindrical tail is black throughout, except for a short strip of about one-fourth the circumference running along the under surface. The general

colour of the pelage in winter is tawny grey, with white on the under-parts and throat, and the face is grey, with a darker forehead, the legs being dark cinnamon colour. In summer the colour changes to bay.

Habits. In habits and gait this deer closely resembles the mule-deer, but it is said to occasionally produce as many as three fawns at a birth. Mr. Grinnell states that the black-tail is chiefly found in the deepest recesses of the coniferous forests of the Pacific ranges, and seldom wanders far away from the protection of the woods. Where they have been but little molested, these deer frequently come down to the shore to feed upon a particular kind of seaweed, and during such visits many are killed by the Indians, who paddle stealthily along the shore in their canoes.

The Pudu Deer.

Genus *Pudua.*

The tiny little deer from the Chilian Andes, known as the pudu (*Pudua humilis*), although allied to the brockets, is so distinct from all others as to necessitate its reference to a separate genus. This deer, which is scarcely larger than a hare, has a rounded head, with rather large ears, between which in the males are a pair of minute spike-like antlers, placed comparatively near together. The fur is of a reddish brown colour, becoming paler on the under-parts. There are no tusks in the upper jaw, and the skull differs from those of all the other American deer except the guemals in that the premaxillary bones, which form the extremity of the muzzle, extend upwards to join the nasal bones covering the cavity of the nose. The ankle-joint exhibits certain peculiarities of structure unknown in any other species.

HEAD OF THE PUDU DEER. (From Sclater, *Proc. Zool. Soc.*, 1866.)

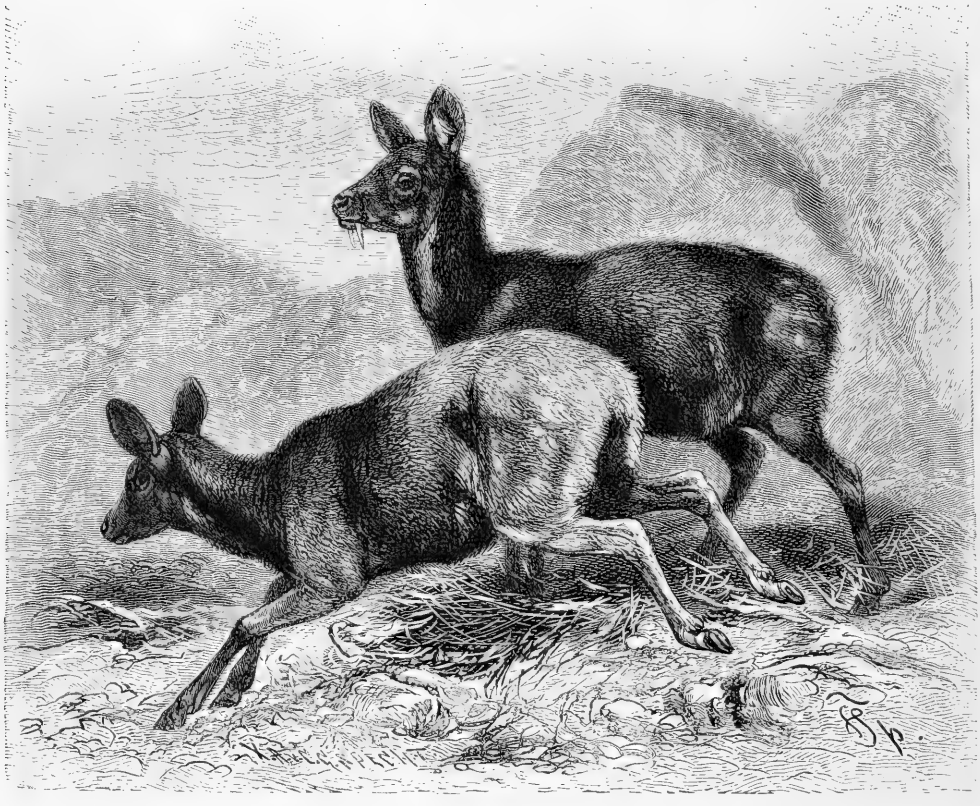
The Musk-Deer.

Genus *Moschus.*

The musk-deer (*Moschus moschiferus*) of the Himalaya differs so remarkably in several important points from all other deer that it must certainly be regarded as forming a subfamily by itself, while some authorities consider it entitled to rank as the representative of a distinct family. These peculiarities are chiefly internal. Among the most important is the presence of a gall-bladder to the liver, as in the Ox family, while the brain is much less convoluted than in other deer The absence of antlers in both sexes cannot, however, be taken as a character of more than generic importance, since the same feature occurs in the Chinese water-deer.

The musk-deer is a somewhat clumsily built animal, standing about 20 inches

in height at the shoulder, and clothed with peculiarly coarse, brittle, and rather long hair, somewhat resembling pith in structure. In addition to the absence of antlers, the skull is characterised by the presence of tusks, which in the males may be as much as 3 inches in length, and project considerably below the mouth. All the limbs are of considerable length, and the hinder pair are longer than the front ones; the hoofs are narrow and pointed, and the lateral pair unusually large. The ears are very large and the tail is short, terminating in the male in a tuft, but



MALE AND FEMALE MUSK DEER ($1\frac{1}{2}$ nat. size).

hairy throughout in the female. The male has a peculiar sac-like gland in the skin of the abdomen, which yields the musk of commerce. The general colour of the fur is a rich dark brown, more or less speckled and mottled with grey and tawny; the individual hairs having black tips, beneath which is a ring of white, while for three-quarters of their length they are white at the base. The chin, the inner borders of the ears and the inside of the thighs, and not unfrequently a spot on each side of the throat, are whitish, while the under-parts and the inner surfaces of the limbs are paler than the body. Some individuals are, however, considerably paler than ordinary, while in others there is a more or less marked yellowish tint; and others, again, are blacker. The young are spotted.

Distribution. The musk-deer is found throughout the Himalaya as far west as Gilgit, and thence extends through Central Asia into Siberia. In

Kansu, on the north-west of China, it is replaced by a nearly allied species (*M. sifanicus*). In the Himalaya it is seldom found below elevations of eight thousand feet in summer, and in Sikhim it occurs above twelve thousand feet.

Habits. Musk-deer are found either in pairs or alone, and in the Kashmir Himalaya are generally met with in the birch-forests above the zone of pines. Sometimes, however, they may be seen at lower levels among thick cover. In habits they have been compared by General Kinloch to hares, and, like these animals, they make a "form," in which they lie concealed during the day, their feeding-time being in the morning and evening. Musk-deer seem capable of enduring almost any degree of cold, against which the peculiar nature of their thick fur is doubtless a sufficient protection. In early spring they may be seen among the steep birch-forests around Kashmir, when the ground is deeply buried in snow, making their way from tree to tree in search of the young twigs and buds upon which they then chiefly subsist. On such ground they are very active and sure-footed, their large lateral hoofs being apparently adapted to aid them in obtaining a foothold on hard snow-slopes and smooth slippery rocks.

General Kinloch states that musk-deer utter a kind of hiss when alarmed, and it is ascertained that when captured they give vent to a series of screams; with these exceptions they appear to be silent, even in the pairing-season. From observations on some musk-deer kept in captivity in Nipal, it appears that the sexes come together in January, and that the fawns are born in June. Usually there is but a single young one at a birth, but occasionally two are produced.

Musk. The musk, which, as already mentioned, is found in the male alone, when fresh is soft and moist, of a brownish colour, and with a rather unpleasant smell. It soon, however, hardens and dries, and at the same time acquires the all-powerful scent of musk. When removed from the dead animal, the secretion is tied up in a portion of the hairy skin covering the gland, and is then known as a "musk-pod." Each pod will contain on an average about an ounce of musk, and in India will fetch some sixteen rupees in the market.

Hunting. English sportsmen hunt musk-deer either by walking through the forests they frequent, and carefully examining every ravine and hollow, or by having the jungles driven by natives. On the other hand, the natives themselves capture these little deer in a wholesale manner, which is described as follows by General Macintyre. "A low fence is made of boughs, etc., along the ridge of a hill, sometimes a mile or more in length. At intervals of 100 or 150 yards are gaps. The musk-deer, crossing the ridge from one valley to another, come across this fence, and, to save themselves the trouble of jumping over it, walk alongside until, seeing a little gap, they try to go through it. But in each gap a noose of strong string is placed on the ground and tied to a stout sapling bent downwards. The noose is so arranged that, when the deer tread inside it, the sapling is loosed and flies back, leaving the noose tied tightly round the animal's leg. The people visit these fences every two or three days, and secure the deer thus caught, and repair the fences and nooses, which are often carried away or destroyed by larger game." In spite of the constant persecution to which they are subject, musk-deer are still fairly common in many parts of the Himalaya, where they are known by the name of kastura.

CHAPTER XXIV.

Ungulates,—*continued.*

Chevrotains and Camels.

Families *Tragulidæ and Camelidæ.*

With the Deer family we took leave of the last of the two Ruminants—the Pecora of the scientific zoologist—and we now come to two smaller groups of Ungulates, which, although Ruminants in the general sense of that term, yet differ so widely from the Pecora, and also from one another, that they are each regarded as constituting sections of equal value with the latter. These two groups are, firstly, the small deer-like animals commonly known as chevrotains, and, secondly, the camels; the latter term including not only the true camels of the Old World, but likewise the South American llamas.

Both these groups agree with the true Ruminants in having crescent-like (selenodont) molar teeth; but whereas the chevrotains are probably descended from the same ancestral stock as that which gave rise to the deer, it appears that the camels have originated from a totally different stock, and have thus acquired their crescent-like teeth quite independently of the true Ruminants. In addition to forming two distinct families, these two groups have also received names of a superior grade, thus bringing them on to a platform equivalent to that occupied by the Pecora. For the chevrotains the term Tragulina is adopted, while that of Tylopoda is taken for the camels.

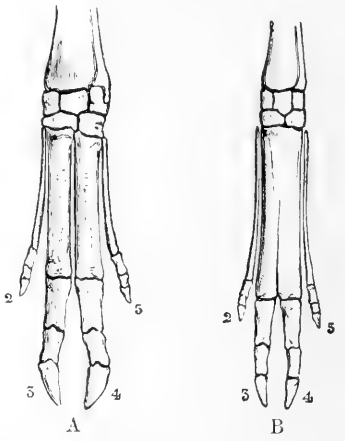
The Chevrotains.

Family *Tragulidæ.*

The elegant little creatures known as chevrotains, or mouse-deer, are so like small antlerless deer in general outward appearance, that they are commonly regarded as nearly allied to the musk-deer, near which they were indeed long placed by zoologists. In zoology, as in many other things, outward appearance is, however, very often deceptive; and when the chevrotains are examined anatomically they are found to depart very widely from the deer family.

Chevrotains agree with the true Ruminants in the absence of any incisor teeth in the upper jaw; and they resemble the musk-deer in the presence of upper tusks, or canine teeth, which in the males attain a considerable length, and project below the mouth. They likewise agree with the true Ruminants in that the canine teeth of the lower jaw resemble the incisors, to the outermost pair of which they are

approximated so as to form a continuous series. When we have added that the three molar teeth and the last premolar tooth in the upper jaw, together with the lower molars, are of a crescent-like type, the resemblances to the true Ruminants cease. In the first place, the three premolar teeth, with the exception of the last in the upper jaw, instead of being crescent-like, have their crowns elongated and narrow, with sharp cutting edges. Then the second, or axis, vertebra of the neck has a simple conical peg (odontoid process) projecting in front, by which it articulates with the first, or atlas, vertebra; whereas in all the true Ruminants the same process is spout-like. On examining the limbs in the skeleton of a chevrotain, it will be found that the fibula, or smaller bone of the lower leg, is complete, instead of being represented only by its lower end. Moreover, each foot has four complete digits, that is to say, the metacarpal and metatarsal bones, respectively supporting the toes of the fore and hind-feet, are complete, and extend alongside of the cannon-bone from the basal joints of the toes to the wrist and ankle joints; whereas, as we have seen, in the true Ruminants these bones are represented either by their upper or lower extremities alone, or are wanting. Then, again, in one of the chevrotains the cannon-bone of the fore-limb is divided into its two component metacarpal elements; while in the other it is wider and less completely soldered than in the true Ruminants. These differences will be apparent by comparing the figures herewith given, with the one on p. 213. Finally, instead of the four distinct compartments characteristic of the true Ruminants, the stomach of the chevrotains has but three such chambers.



LEFT FORE-FOOT OF THE WATER-CHEVROTAIN (*A*) AND INDIAN CHEVROTAIN (*B*).

2 and 5 indicate the lateral digits and 3 and 4 the middle pair. (From Dawkins.)

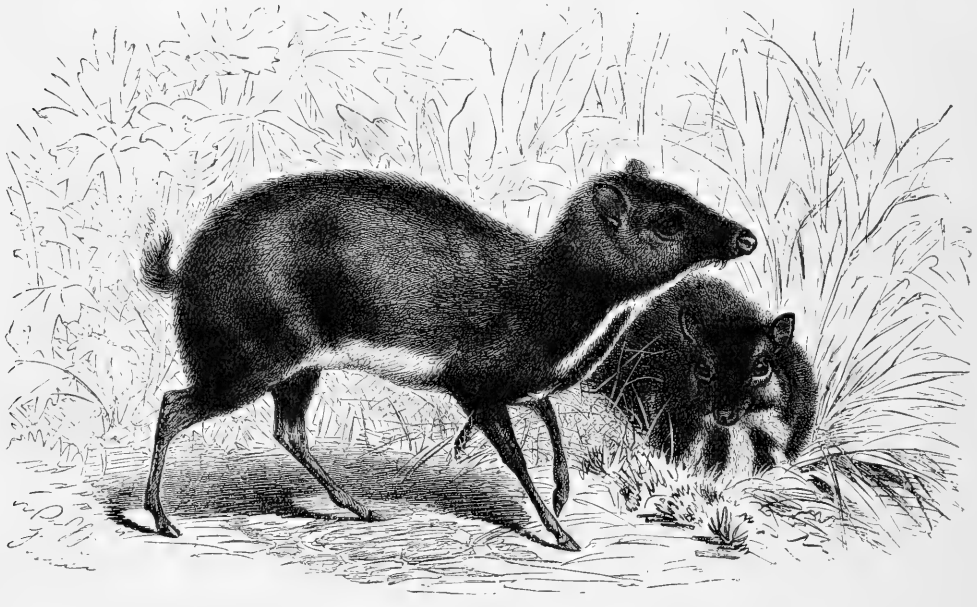
The True Chevrotains.

Genus *Tragulus.*

The chevrotains are divided into two genera, the first of which is Asiatic and the second African. The true or Asiatic chevrotains are represented by five species, of which the range extends from India and Ceylon through the Malayan Archipelago to the Philippines. They are characterised by the two median metacarpal bones of the fore-limb being fused into a cannon-bone (*B* of the figure), and also the small size of the lateral toes. With one exception, they are the smallest of living Ungulates, and much resemble the American Rodents known as agutis in general appearance and habits.

Of the five living species of the genus, one is confined to India and Ceylon, while the others are found in the regions to the eastward of the Bay of Bengal. The Indian chevrotain (*Tragulus meminna*) differs from all the others in having the body spotted with white, and the whole of the chin and throat uniformly

covered with hair. It is of medium height, standing from 10 to 12 inches at the withers, and weighing from 5 to 6 lbs. In colour, the upper-parts are brown of variable shade, minutely speckled with yellow; while the flanks are spotted with white or buff on a brown ground; the spots being more or less elongated, and often passing into short longitudinal stripes. This chevrotain is found in Southern India and Ceylon at elevations below two thousand feet, extending northwards as far as Orissa on the east coast, and to the Western Ghats near Bombay on the west. The other four species have the upper-parts of the body uniformly coloured, and the skin between the two branches of the lower jaw completely naked and glandular. Of these the largest species is the larger Malayan chevrotain (*T. napu*), standing 13 inches in height at the shoulder, and characterised by its dark smoky-



THE SMALLER MALAYAN CHEVROTAIN ($\frac{1}{2}$ nat. size).

grey colour, with the under-parts greyish-white without any rufous or fulvous edging. This species occurs in South Tenasserim, the Malay Peninsula, and the islands of Sumatra and Borneo.

The two other Malayan species are rufous either over the whole of the upper-parts or on the flanks and the edges of the white area of the under-parts. Stanley's chevrotain (*T. stanleyanus*), from some of the Malayan Islands, is intermediate in size between the preceding and following species, and has all the upper-parts bright rufous. On the other hand, the smaller Malayan chevrotain (*T. javanicus*), which is the one represented in our illustration, is the most diminutive member of the group, and is greyish above, with the sides brightening to rufous, and a dark line, which may be nearly black, running along the nape of the neck. The under-parts are whitish, more or less mixed with rufous, but there is generally (as in our illustration) a broad reddish or brown stripe running up the front of the chest. With the exception of the royal antelope (p. 307), this chevrotain is the

smallest of all living Ungulates; it has a very wide geographical distribution, being found in Cambodia, Cochin-China, South Tenasserim, the Malay Peninsula, Sumatra, Java, and Borneo. The last species is the Philippine chevrotain (*T. nigricans*), confined to the islands from which it takes its name. Remains of a fossil chevrotain have been discovered in the Pliocene rocks of the Siwalik Hills at the foot of the Himalaya.

Habits. All the chevrotains appear to be very similar in their habits. They have a peculiar way of walking in a mincing manner on the extreme tips of their hoofs, which communicates a stiff and rigid appearance to the legs, and has thus given rise to the popular notion that these animals have no joints. Chevrotains lie concealed in grass or jungle, and only venture out to feed in the evenings and mornings. They are timid and shy, but in confinement soon become tame and gentle, and have been known to breed. Writing of the Indian species, Colonel Tickell observes that it "is found throughout the jungly districts of Central India (*i.e.*, Chutia Nagpur), but from its retired habits is not often seen. It never ventures into open country, but keeps among rocks, in the crevices of which it passes the heat of the day, and into which it retires on the approach of an enemy. In these the female brings forth her young (two in number), generally at the close of the rains or the commencement of the cold season. The male keeps with the female during the rutting season (about June or July), but at other times they live solitary." The smaller Malayan chevrotain, which is very common in the Peninsula, inhabits dense thickets, and produces either one or two fawns at a birth.

The Water-Chevrotain.

Genus *Dorcatherium.*

The water-chevrotain (*Dorcatherium aquaticum*) of the West Coast of Africa, is the only surviving representative of a genus which appears to have been widely spread in the Old World during the Pliocene and Miocene epochs of the Tertiary period. Indeed, the genus was originally founded upon the evidence of one of these extinct species, the living form having been subsequently described under the name of *Hyomoschus*, and it is only recently that zoologists have generally recognised the generic identity of the recent and fossil species.

The water-chevrotain is mainly distinguished from the true chevrotains of Asia by the feet being shorter and stouter, with relatively larger lateral toes, and, above all, by the circumstance that the two middle metacarpal bones remain completely separate, as shown in the figure on p. 399. The living species is slightly superior in size to the largest of the Asiatic chevrotains, and resembles the Indian representative of the latter in having the body spotted and striped with white. The general colour of the fur is a rich brown, with a large amount of white on the throat and chest, as well as on the under surface of the tail; the upper part of the body is spotted, while the flanks are marked with longitudinal white stripes, which are larger and more continuous than those of the Indian chevrotain.

As is the case with so many West African animals, we have but scanty information as to the habits of the water-chevrotain in its native state. It is, however,

generally found near the banks of river and lakes, and its mode of life is said to be much like that of pigs.

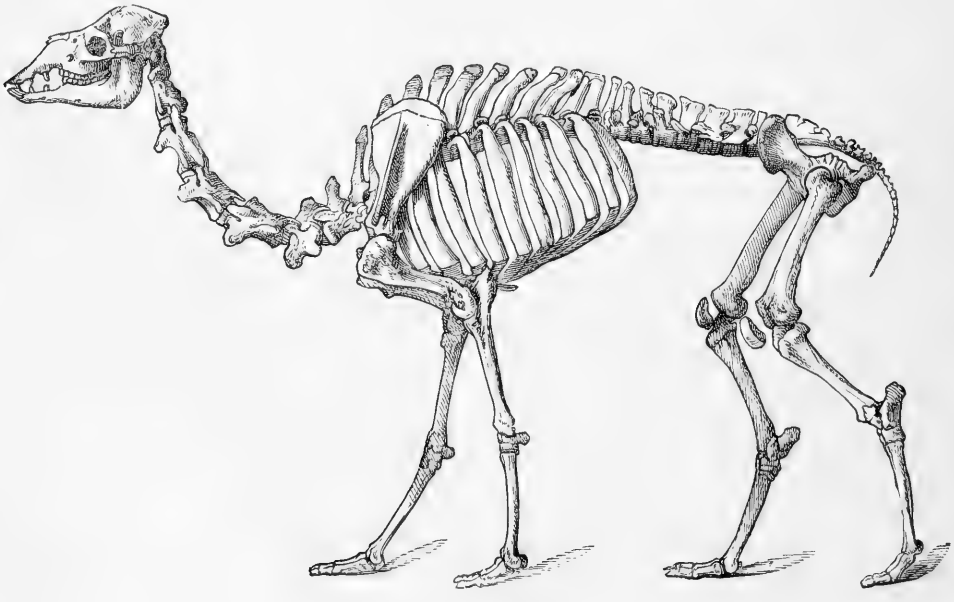
The water-chevrotain has but three premolar teeth in the lower jaw, but in the somewhat larger species found in the Pliocene and Miocene strata of Europe there were four of these teeth. The species occurring in the Pliocene of the Punjab was of still larger dimensions; and affords one more instance of the intimate connection existing between the Tertiary Mammalian fauna of India and that of Africa at the present day.

Extinct Forms. In its separate metacarpal bones, the water-chevrotain makes a decided approach towards the pigs; and in the Tertiary deposits of Europe and North America there occur numerous small Ungulates, which appear to have connected the chevrotains with the deer. Such is *Gelocus*, from the lower Miocene of France, in which the middle metacarpal bones were separate, while the metatarsals were fused into a cannon-bone, which has been regarded as the common ancestor of the two families. *Prodremotherium* of the upper Eocene of France, has cannon-bones in both limbs; while in the American *Hypertragulus* both the metacarpals and metatarsals were separate.

The Camels and Llamas.

Family *Camelidæ*.

The camels of the Old World, and the llamas of the New, form, as already stated, a group of ruminating Ungulates distinguished widely both from the true



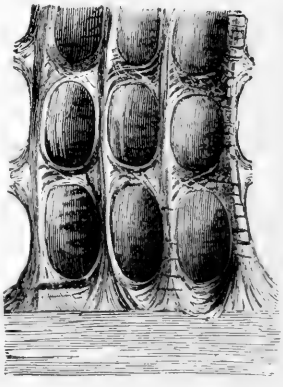
SKELETON OF THE ARABIAN CAMEL.

Ruminants and the chevrotains, and which probably have had a totally distinct origin from more primitive even-toed Ungulates.

An important point of distinction is that the front of the upper jaw is furnished with incisor teeth; it is true, indeed, that in the adult state there is only a single pair of these teeth remaining, but in young animals there are, as in pigs, three pairs. Then, again, both jaws are furnished with tusks or canine teeth; those of the lower jaw being sharply pointed, and separated by an interval from the incisors, instead of resembling the latter and forming with them a continuous series, as we have seen to be the case in the chevrotains and the true Ruminants. The molar teeth have tall and crescent-shaped crowns, which, however, are not precisely similar to those of the group last-named; and one, or sometimes more, of the premolar teeth generally has a simple pointed crown, like that of a canine, and is not in contact with the other teeth of the cheek-series. These isolated premolar teeth are seen in the figure of the skeleton of the camel, in the gap between the tusks and the other cheek-teeth.

BONES OF THE LEFT FORE-FOOT OF THE CAMEL. (From Dawkins.)

The limbs are long, and the thigh is placed nearly vertically, so that the true knee is more detached from the small hind-quarters of the body than is usually the case in Ungulate mammals. The lower portion of the legs is composed of a cannon-bone supporting two toes, without any trace of the lateral toes or their metacarpal bones. The cannon-bone differs, however, from that of the true Ruminants, in that the two pulley-like surfaces at the lower end, instead of being placed side by side and furnished with a distinct ridge in the middle of each, are divergent and perfectly smooth. The bones of the first joint of the toes are also longer and more expanded at their lower ends than in the true Ruminants; the second pair being broad and flattened, while the third form mere nodules, quite unlike the symmetrical ones of the latter group. The feet form broad expanded cushion-like pads (from which the group derives its title of Tylopoda), of which the under surface is undivided, while the front shows a division into two toes, each of which bears a broad nail on the upper surface. The ankle-joint differs from that of the true Ruminants in that the two bones lying immediately below the astragalus, remain distinct, whereas in the former they unite into a compound bone, termed the naviculo-cuboid. A further distinction is to be found in the divided upper lip, like that of a hare; while the elongated neck is characterised by the great length of its component vertebræ. These vertebræ exhibit certain peculiarities of structure into the consideration of which we need not enter here; but it must be observed that they resemble those of the true Ruminants in that the process in front of the second vertebra, by which it articulates with the first, is spout-shaped. Here, then, we have another instance of a similar structure being independently acquired in two distinct groups. The head is carried high in the air, with the upper part of the neck nearly vertical; and is unprovided



WATER-CELLS IN STOMACH OF CAMEL.

with either horns or antlers. The stomach has but three compartments; the first two of these being provided with a number of cells or pouches which can be closed by the action of muscles, and these contain only fluid. The bones of all the members of the family are remarkable for their extremely solid and ivory-like structure.

The camel family, in proportion to its extent, is more valuable to mankind than any other group of even-toed Ungulates, only one species being unknown in the domesticated condition, while two are now found exclusively in that state. The Old and New World representatives constitute two distinct genera, the former of which we take first.

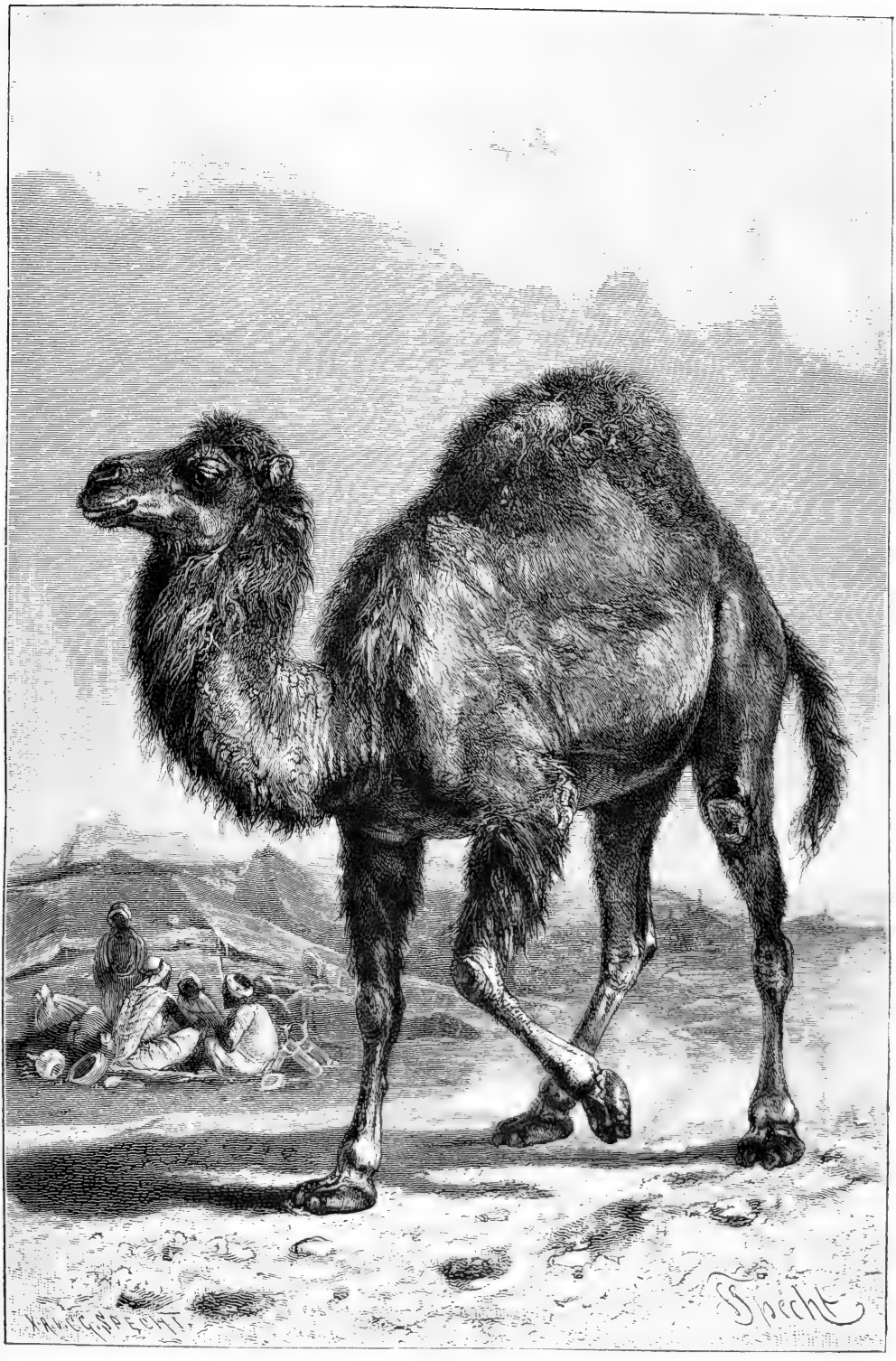
The Camels.

Genus *Camelus*.

The camels of the Old World, of which there are two distinct species, are characterised by their great bodily size and bulk, and the presence of one or two large fatty humps on the back, as well as by having six upper and five lower cheek-teeth on each side of the jaws, the total number of teeth being thirty-four. Their ears are comparatively short and rounded; and the hair is very irregularly disposed, being in some places very long and shaggy, and in others short and close, although never partaking of the nature of true wool. The feet are broad, with the toes very imperfectly separated; and the tail is comparatively long, reaching nearly to the hocks, and furnished near the end with long hair forming a terminal tuft. Callous pads, on which the animal rests when lying down, and which are present at birth, are found on the chest, the elbows, the wrists (commonly called the knees), and the knees. Needless to say, the whole form of these animals is far from beautiful, while the head is ugly in the extreme; and this want of bodily beauty is accompanied by a viciousness of temper and general stupidity of disposition which can scarcely be paralleled elsewhere among domesticated animals.

The two species of camel are both now unknown in the wild condition, although in some localities there are half-wild herds of which the parents have escaped from captivity. There is also a half-breed between the two species, which is said by the tribes among which it is bred to display better qualities than either of the parent stocks.

Arabian Camel. The first of these two species is the true or Arabian camel (*Camelus dromedarius*), which is found both in Africa and Asia, and is characterised by its single hump. It is a long-limbed animal, with a comparatively short coat of hair, and soft feet, adapted for walking on yielding sandy soil, and standing from about 6 feet 8 inches to 7 feet in height. The head is comparatively short, with a long and sloping muzzle, and convex forehead; the eyes are large, with a soft expression; and the small rounded ears are placed far back on the sides of the head. The upper lip overhangs the lower; and the large slit-like nostrils can be closed at will. The long neck is laterally compressed, and thickest in the middle; and the body is massive and rounded. The contour of the back rises from the setting on of the neck to the loins, and then falls rapidly away



ARABIAN CAMEL.

to the tail. The hump, when the animal is in good condition, stands upright, but it alters considerably in shape according to age. The richer the food of the camel, the larger is its hump; while, when the food is poor and dry, the hump decreases in size; and accordingly in the rainy season this appendage attains its maximum development, while in the dry months it proportionately shrinks. In high-conditioned animals, the hump should form a regular pyramid, and occupy at least a quarter of the whole length, but when the animals are half-starved it almost disappears. The hair is soft, and on the hinder part of the head, the neck and throat, the shoulders, the hump, and the upper part of the fore-legs, is longer than elsewhere. The colour of the hair is very variable, although a light sandy is the most common hue; there are, however, white, grey, brown, and even totally black camels; but those of the last-named colour are held by the Arabs to be worthless.

Various Breeds. There are numerous breeds of camels differing more or less from another, and the Arabs recognise no less than twenty distinct strains. Roughly speaking, they may, however, be divided into two classes, namely, baggage-camels and riding-camels, or dromedaries; and Sir Samuel Baker observes that there "is the same difference between a good *hygin*, or dromedary, and a baggage-camel, as between the thoroughbred and the cart-horse; and it appears absurd in the eyes of the Arabs that a man of any position should ride a baggage-camel. Apart from all ideas of etiquette, the motion of the latter animal is quite sufficient warning. Of all species of fatigue, the back-breaking monotonous swing of a heavy camel is the worst." The peculiarly unpleasant motion of even the best camels is due to the circumstance that the two legs of one side are moved simultaneously. The ordinary pace of a baggage-camel is from two and a half to three miles an hour when fully loaded, but a good dromedary will keep up a pace of from eight to ten miles an hour for a long period.

Habitat. Arabian camels are now found in the domesticated condition in all parts of Africa, lying between the Mediterranean and the 12th parallel of north latitude, while in Somaliland they extend as far south as the 5th parallel. They are also widely distributed in South-Eastern Asia, ranging from the lowlands of Afghanistan and Bokhara, where they impinge on the habitat of the two-humped Bactrian camel, through North-Western India, Persia, Asia Minor, Syria, and Arabia. In Asia Minor and Khorasan, there is a race of half-breeds between the Arabian and the Bactrian camel; this breed being known in the last-named country as the Boghdi camel. According to Elphinstone, it has the two humps of the Bactrian species, but the long limbs of the Arabian: and it appears to be generally a product of crossing a male of the former with a female of the latter. Arabian camels have also been introduced into the Canaries, Australia, North America, Italy, the south of Spain, and Zanzibar.

There has been much discussion as to what country was the original home of the Arabian camel; but it has been considered that Arabia has the best title to this honour. This conclusion appears to rest partly on the statements of Diodorus Siculus and Strabo that wild camels existed in Arabia at the commencement of the Christian era, and partly on the circumstance that no representations of camels occur in the ancient Egyptian frescoes. Whatever may be the value of the statements referred to, there can be no question but that the absence of pictures of

these animals from the frescoes of Egypt does not support the conclusion that they were introduced at a comparatively late date into that country. For there is evidence furnished by a papyrus of the 14th century B.C. that camels were at that early period well known in Egypt. Possibly there were some superstitious or other reasons which led to the exclusion of their portraits from the frescoes.

A certain amount of light is thrown on the question by the occurrence of fossilised remains of extinct camels in the Pliocene rocks of the Siwalik Hills, at the foot of the Himalaya, and also in beds belonging to the succeeding Pleistocene period in Algeria. And knowing, as we do, that so many of the African genera of Mammals have taken origin in India, from whence they have migrated to their present home, it would seem highly likely that the same may have been the case with the camels. The Arabian camel, or its immediate parent, may, therefore, have sprung from an Indian ancestor, and thence made its way through Arabia and Syria into Northern Africa.

The Arabian camel is essentially an animal fitted to exist only in dry or desert districts, and consequently all attempts to introduce it into the moist and wooded regions of Southern India and Equatorial Africa have signally failed. Where, however, the climate is at all favourable, its introduction into new regions has generally been attended with success. Camels are reported to have been introduced into Italy in the year 1622, and again in 1738. On a flat plain near Pisa the number in 1810 was forty, and in 1840 forty-one, while later it had increased to upwards of two hundred. Their attempted introduction into Sicily, as beasts of burden in the sulphur mines, was, on account of the climate, a failure; but in Spain they appear to have thriven.

In the year 1856 a drove of seventy-five camels was procured from Smyrna by the United States Government, and distributed over Texas, Arizona, and New Mexico. During the war of secession, the whole of these animals fell into the hands of the Confederates, and were used for carrying the mails, some of them making journeys of upwards of 120 miles in a day. At the conclusion of the war the remnant of these once more came under the Government of the United States, and others were purchased in 1866. These were distributed through Arizona and Texas for breeding purposes; but many died, and the experiment proved unsatisfactory. Consequently, those that survived were turned adrift to shift for themselves; and it appears that some still remain in the wilder districts of California and Arizona, and wander over a considerable area in the course of the year. In Australia, the introduction of camels has been a greater success, and they have proved invaluable in the expeditions which have been undertaken to explore the deserts of the interior.

Habits. The food of the camel in its natural state probably consisted entirely of branches and leaves of trees, and although grain is now largely given, a certain amount of green-food is absolutely essential to the animal's health. No matter how thorny the boughs may be, they are quite acceptable to the camel; and it is perfectly marvellous how the animals manage to eat such food without injury to their mouths. On such a diet, or even on dates, camels will do well; but when compelled to work for days with little or no food, they soon break down, as was disastrously shown in the expedition to Khartum.

For a few days, owing to the peculiar conformation of their stomachs, camels can exist comfortably without water, but their endurance in this respect is often taxed sadly beyond its natural capability.

Although the camel is undoubtedly the most valuable and useful of all animals in dry and desert countries, its disposition and temper are decidedly of the very worst description. In addition to its ordinary surliness and want of attachment to its master, the male camel during the pairing-season is subject to almost uncontrollable outbreaks of rage; and, at the same time, owing to a swelling of the uvula, makes a loud bubbling noise which is most unpleasant to the human occupants of the camp. An instance of the savage disposition of camels is afforded by the habit they have, when passing a mounted man on a narrow path, of turning their heads suddenly round and endeavouring to inflict a bite on the rider's arm or shoulder; a camel's bite being, by the way, exceptionally severe. Writing of the character of the camel, Dr. Robinson observes, that these animals "are commonly represented as patient, but if so, it is the patience of stupidity. They are rather exceedingly impatient, and utter loud cries of indignation when receiving their loads, and not seldom on being made to kneel down. They are also obstinate, and frequently vicious; and the attempt to urge them forwards is often very like trying to drive sheep the way they do not wish to go."

So again, Palgrave writes that the camel "takes no heed of his rider, pays no attention whether he be on his back or not, walks straight on when once set agoing, merely because he is too stupid to turn aside, and then should some tempting thorn or green branch allure him out of the path, continues to walk on in the new direction, simply because he is too dull to turn back into the right road. In a word, he is from first to last an undomesticated and savage animal, rendered serviceable by stupidity alone, without much skill on his master's part, or any co-operation of his own save that of an extreme passiveness."

Uses. In addition to its value as a beast of burden, the camel is also esteemed by the natives of many countries on account of its milk and flesh, while its hair is woven into ropes and cloth, and in some parts of India its bones are used in lieu of ivory for inlaying and turning. The milk is extremely thick and rich, but is unsuitable for use with tea or coffee, as it then immediately curdles. From remote antiquity camels have been kept in enormous herds by Eastern nations. In modern times the Arabs of the Sudan possess immense herds, which in the rainy season are driven northwards in thousands; and in some parts of North-Western India the number of camels kept by the natives must be very large. When the young camels are too feeble to undergo the fatigues of a day's march, they are slung in nets on the backs or by the sides of some adult members of the drove. But a single calf is produced at a birth, after a gestation of rather more than eleven months; and the calf is suckled by the dam for at least a twelvemonth.

In the Sudan the price of a riding-camel varies from about £10 to £15, while a good baggage-camel can be purchased for about £4, 10s. Young or weak camels may be bought for as little as 30s.

Aversion to Water. Camels have a great aversion to crossing even the smallest stream, and swim either imperfectly, or not at all, without assistance;

this aversion doubtless indicating that the original home of the animal was in desert lands. On this subject Sir Samuel Baker observes, that "a camel either cannot or will not swim, unless it is supported by inflated skins; thus the passage of the broad river, Atbara (about 300 yards wide), is an affair of great difficulty. Two water-skins are inflated, and attached to the camel by a band passed like a girth beneath the belly. Thus arranged, a man sits upon its back, while one or two swim by the side as guides. The current of the Atbara runs at a rapid rate; and the camel is generally carried at least half a mile down the river before it can gain the opposite bank."

Bactrian Camel.

The Bactrian camel (*C. bactrianus*), of Central Asia, is distinguished from the Arabian species, not only by its double hump,

THE BACTRIAN CAMEL ($\frac{1}{23}$ nat. size).

but likewise by its inferior height, stouter and more clumsy build, shorter legs, and harder and shorter feet, as well as by the greater length and abundance of the hair. This animal is, indeed, in all respects, better adapted for a rocky and hilly country than its southern congener; its shorter and stouter limbs rendering it far less liable to accidents in traversing precipitous ascents. The largest development of hair occurs upon the top of the head, the neck and shoulders, the upper part of the fore-limbs, and the humps.

Distribution. The Bactrian camel is found in nearly all the desert-regions of Central Asia lying between Afghanistan and Turkestan, and China and Southern Siberia. In the regions lying to the eastward of Yarkand, there occur droves of these camels now living in a wild condition, which there is every reason to believe are descended from domesticated individuals escaped from captivity. According to Prejevalski, these wild camels differ from the ordinary domestic race by the smaller size of their humps, the more distinct pads on their wrists (front knees), and certain peculiarities in the conformation of the skull. Major C. S. Cumberland states that "the habitat of the wild camel is the Gobi steppe, from Khotan to Lob Nor. Except when snow lies on the ground, these animals may be met with here and there along the old bed of the Yarkand and Tarim Rivers, which they frequent for the pools of brackish water that are to be found here and there. But as soon as the snow falls, they move off into the desert, as if then independent of the water-supply. They prefer the snow, I imagine, as being less salt than the water, although it also is impregnated to a certain extent soon after it falls. The camel is very shy in its habits, and, so far as I could ascertain, has never been caught and domesticated. The natives told me that no horse in the country could catch the camels in the deep sand of the region they frequent. . . . They vary in colour, like the domestic species, from dark brown to lightish dun. Their origin has yet to be traced. I take it that they have sprung from camels which escaped when the district known as Takla Makun was buried in a great sand-storm some two centuries ago. Tradition relates that no human beings survived, but it is likely enough that some of the camels and horses did so, and that this was the origin of the wild camels and ponies which are found in the district."

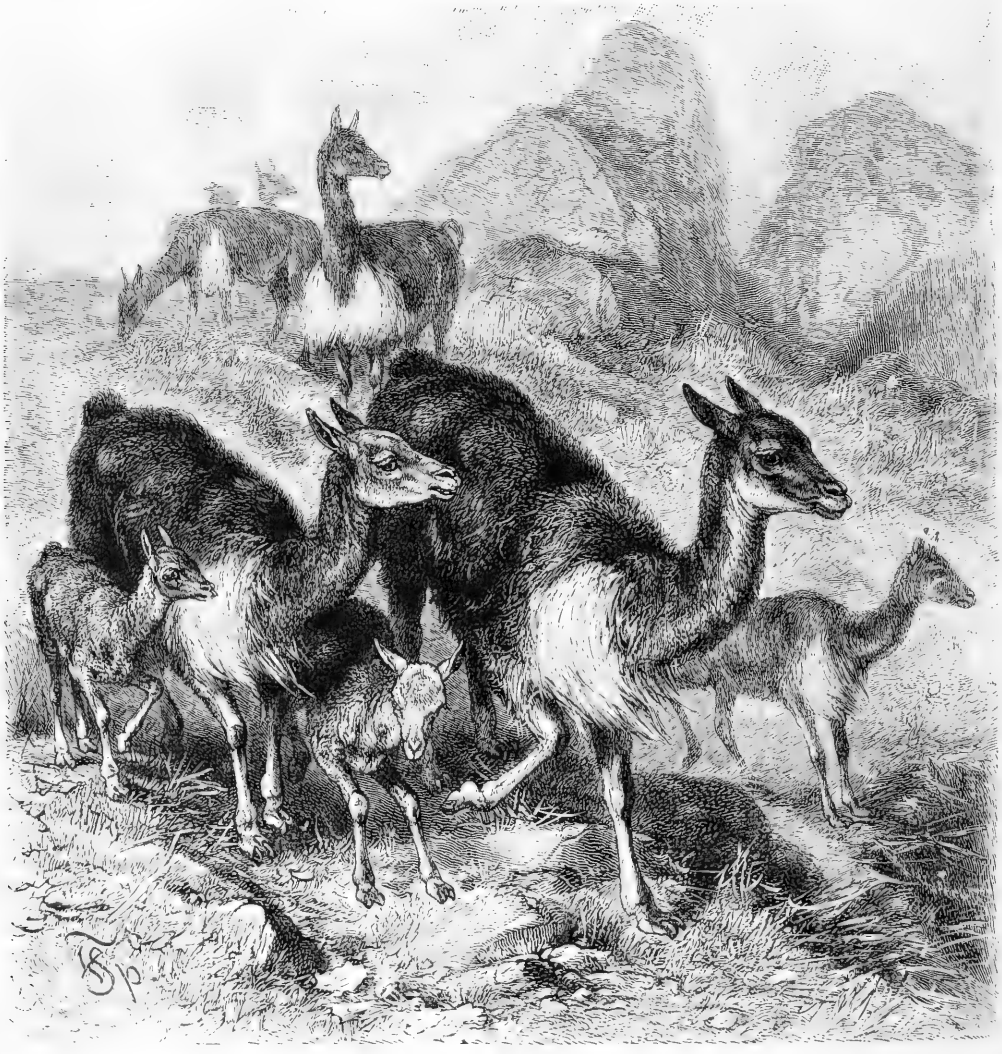
Food. The Bactrian camel feeds chiefly upon the saline and bitter plants of the steppes which are rejected by almost all other animals; and displays a curious partiality for salt, drinking freely at the brackish water and salt lakes, which are so common throughout its habitat. Instead of confining itself to a strictly vegetable diet, the Bactrian camel, according to the reports of Prejevalski, will, when pressed by hunger, readily devour almost anything that it may come across, including felt-blankets, bones and skins of animals, flesh and fish.

Habits. The pairing-season occurs during February, March, and April; and the young (of which but one is produced at a birth) are not born till thirteen months later, so that the period of gestation is considerably longer than in the Arabian camel. At birth the young are so helpless when the animals are kept in the domesticated state that they have to be attended with the greatest care; but they very soon gain strength, and in about a week are able to eat. They are weaned at an early period for the sake of the milk of the parents, which is largely used by their owners. In their third year they are ridden on short journeys, while in their fifth year they attain their full stature and vigour; and with good management they are said to be serviceable until they attain the age of some five-and-twenty years. In Mongolia and on the Kirghiz steppes the Bactrian camel is fully as important to the nomad inhabitants as is its southern cousin in Arabia.

The Llamas.

Genus *Lama.*

Under the general title of llamas may be conveniently included all the existing South American representatives of the camel family, although that name properly belongs only to a domesticated variety of one of the two wild species.



A DROVE OF VICUNIAS ($\frac{1}{10}$ nat. size).

All the llamas are smaller in size and lighter in build than the camels, and owing to the absence of any hump on the back depart less widely from the ordinary type of Ungulates. Their pointed ears are relatively much longer than in the camels, while their thickly-haired tails are reduced to little more than a stump. The feet, again, are narrower and more pointed than in their Old World relatives, and have

their toes more completely separated, each toe being furnished with a distinct pad on the sole. The whole of the body is covered with a thick coat of long hair partaking of a woolly nature; and there are fewer callosities on the limbs than in the camels. As characters of minor import, it may be added that the head is proportionately longer than in the latter, and has a tapering and sharply-pointed muzzle, while the neck is relatively thinner.

The skull has one tooth on each side of the upper jaw less than in the camels, the missing tooth being the isolated sharp-pointed premolar which is found in the latter in the middle of the gap between the tusk and the main series of cheek-teeth. Consequently the total number of teeth is only thirty-two instead of thirty-four. The premolar tooth in the lower jaw, which is of very small size, not unfrequently, however, falls out in the adult, and thus reduces the number to thirty.

Distribution. Llamas at the present day are entirely confined to the western and southern regions of South America, and can live only where the climate is temperate. Thus on the western side of the continent they are restricted to the higher ranges of the Andes and Cordilleras, but in many parts, Patagonia and Tierra-del-Fuego, they flourish on the plains at the sea-level. In the neighbourhood of the Equator they are generally found at elevations of between twelve thousand and sixteen thousand feet above the sea, and they never descend lower than between six thousand and seven thousand feet. During the rainy part of the year the wild species which inhabit the mountains ascend to the limits of vegetation, but in the hot season they descend to the valleys where alone sustenance is to be found. They live in larger or smaller parties, and sometimes congregate in herds comprising many hundreds of individuals. All the species are characterised by their very objectionable habit of spitting, as many visitors to zoological gardens well know.

Species. There are two wild species of llama now existing, respectively known as the vicunia and the guanaco, and likewise two domesticated races, namely, the llama and the alpaca. For a long period much uncertainty existed as to the relationship of these domesticated races to the wild species, but the researches of Mr. O. Thomas have led to the conclusion that both the former are in all probability derived from the wild guanaco, with which they agree in the proportionately large size of their skulls, and the presence of naked patches on the hind-limbs.

Vicunia. The vicunia (*Lama vicunia*) is the smaller of the two wild species, and is of a uniform light-brown colour, becoming paler on the under-parts and limbs, and with light markings on the face and jaws. The build of the animal is very light and graceful; its head is relatively short, and it has no naked callosities on the hind-legs. In correlation with the shortness of the head, the skull is of proportionately small size. This species has a somewhat restricted range, being confined to the mountains in the district between Southern Ecuador and Central Bolivia, which includes the whole of Peru.

Habits. According to the account of Tschudi, during the wet season of the year the vicunias seek the highest ridges of the Cordillera, where plant-life is but sparse. On account of the softness of their feet, they prefer upland meadows, and avoid the stony, naked peaks, while they still more carefully

shun glaciers and snow-fields. In the hot season, on the other hand, they descend into the higher valleys. The reason of this reversal of the usual plan of migration appears to be that in the Cordillera the vegetation on the higher ridges is completely withered up by the heat of the dry summer season, and that such herbage as remains is only to be found in the valleys, where it is nourished by springs or swamps. Vicunias feed all day, and it is seldom that a flock is seen lying down. During the pairing-season the males fight with great fierceness for the supremacy of the flocks, each of which comprises one male accompanied by from six to fifteen females. The male always remains a few paces behind the flock, and gives notice of any approaching danger by uttering a shrill whistle, at the same time rapidly advancing; the flock then collects, and takes to immediate flight in a swift gallop, the male bringing up the rear, and often stopping to observe the foe.

In the month of February the females give birth to a single fawn, which as soon as it comes into the world is endowed with remarkable speed and endurance. The young males remain with their dams until full grown, when they are expelled from the flock by the united force of females. These young males unite together in separate flocks of from twenty to thirty head; and as such flocks have no special guardian, but all the members are constantly on the alert, they are exceedingly difficult to approach. During the pairing-season incessant fights take place among these male flocks, and the animals then utter a peculiar neighing sort of cry which can be heard at a great distance.

Hunting. The Indians hunt vicunias by forming a circular enclosure of stakes connected by cords, with a diameter of about half a mile, and an entrance of some couple of hundred feet in width. The cords connecting the stakes are hung with bright-coloured pieces of cloth, which flutter in the wind and prevent the animals from trying to break through. When the enclosure is ready, the hunters make a wide circuit on the mountains, and drive in all the flocks of vicunias there may be in the neighbourhood; the animals being despatched by the bolas—a weapon consisting of two large balls connected by a string, which is whirled round the hunter's head and then hurled with unerring aim at his victim. The flesh is divided among the Indians, but the skins belong to the priests. The wool, although small in quantity, is fine and of excellent quality; and in 1826 a law was made that the vicunias should be caught and shorn, instead of killed, but the wildness of the animals rendered this impracticable. In the time of the Incas vicunia-hunts, in which as many as thirty thousand men took part, were organised upon a large scale. An area of some twenty miles would be completely surrounded, and every living thing driven in; and it is said that at times as many as forty thousand head of game, including bears, pumas, foxes, deer, vicunias, and guanacos, would be thus surrounded. Such a hunt would last for a week, during which many hundred head of game would be killed, Tschudi mentioning that in a hunt which he joined, upwards of one hundred and twenty-two vicunias were slaughtered.

Guanaco. The guanaco (*L. guanacus*) is a rather larger and heavier-built animal than the vicunia, with a longer head, larger skull, and distinct naked patches on the knees of the hind-legs. A full-grown male will measure 4 feet in height at the shoulder, and from 7 to 8 feet in length. The thick and woolly hair is of a pale reddish colour, longest and palest on the under-parts. The

geographical range of this species is very wide, extending from the lofty mountains of Ecuador and Peru, where it is found in company with the vicunia, to the plains of Patagonia and the islands of Tierra-del-Fuego.

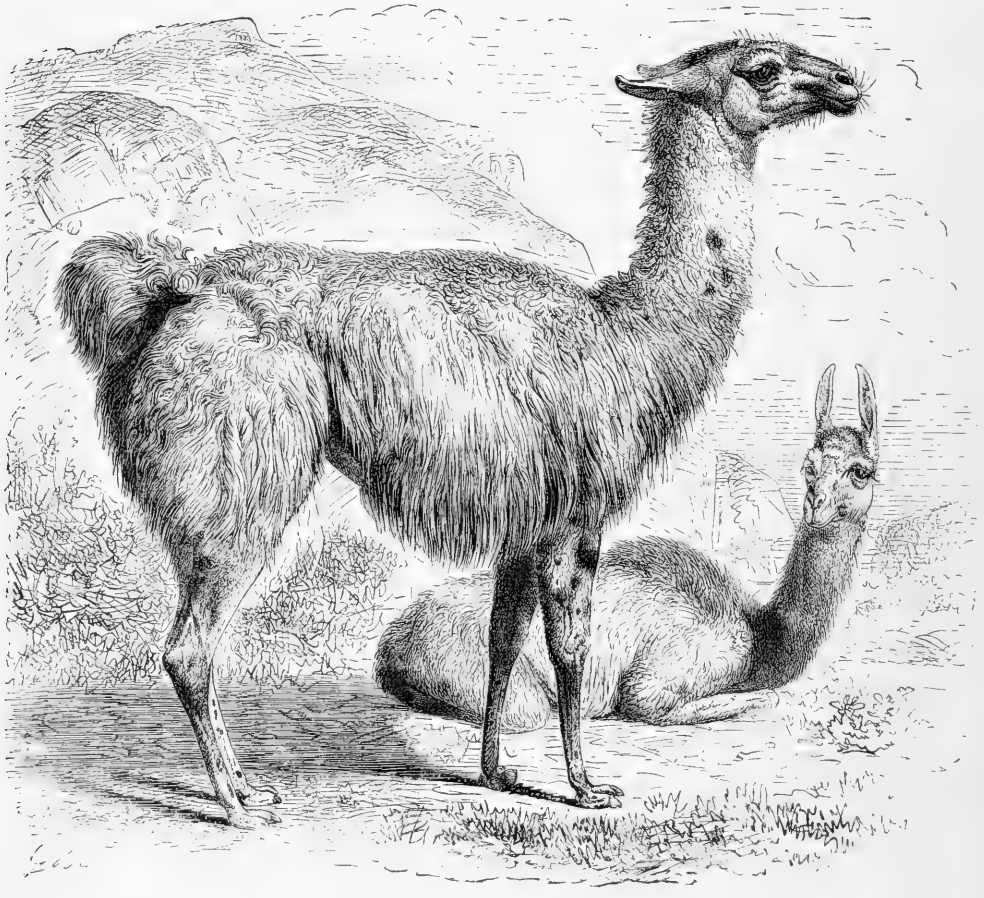
Habits. In the mountains the habits of the guanaco appear to be very similar to those of the vicunia, but it is not unfrequently seen in larger flocks, which may occasionally reach as many as one hundred or even five hundred head. The pairing-season occurs in August and September, and the young are born ten or eleven months afterwards. Darwin states that these animals are very wild and wary, and that frequently the first evidence of their presence in the neighbourhood of the hunter is their loud, neighing alarm-cry, which makes itself heard at a great distance. If the hunter looks attentively, he will then, writes Darwin, "probably see the herd standing in a line on the side of some distant hill. On approaching nearer, a few more squeals are given, and off they set at an apparently slow but really quick canter, along some narrow beaten track to a neighbouring hill. If, however, by chance he abruptly meets a single animal, or several together, they will generally stand motionless and intently gaze at him, then perhaps move on a few yards, turn round, and look again." The writer then proceeds to give instances of their extreme curiosity, and adds that they are easily domesticated, and in the wild state have no notion of defending themselves. He continues that "guanacos take readily to the water; several times at Port Valdes they were seen swimming from island to island. Byron, in his voyage, says he saw them drinking salt-water. Some of our officers likewise saw a herd apparently drinking the briny fluid from a salina near Cape Blanco. I imagine in several parts of the country if they do not drink salt-water they do not drink at all. In the middle of the day they frequently roll in the dust, in saucer-shaped hollows. The males fight together; two one day passed quite close to me, squealing and trying to bite each other; and several were shot with their hides deeply scored. Herds sometimes appear to set out on exploring parties; at Bahia Blanca, where, within thirty miles of the coast, these animals are extremely unfrequent, I one day saw the tracks of thirty or forty, which had come in a direct line to a muddy salt-water creek. They then must have perceived that they were approaching the sea, for they had wheeled with the regularity of cavalry, and had returned in as straight a line as they had advanced."

Dying-Places. The most singular circumstance connected with the guanacos is their habit of resorting to certain particular spots when they feel their end approaching. On this point Darwin observes that "on the banks of the Santa Cruz, in certain circumscribed spaces, which were generally bushy and always near the river, the ground was actually white with bones. On one such spot I counted between ten and twenty heads. I particularly examined the bones; they did not appear, as some scattered ones which I had seen, gnawed or broken, as if dragged together by beasts of prey. The animals in most cases must have crawled before dying beneath and amongst the bushes." Although mentioning that wounded guanacos invariably make their way towards the river, Darwin did not attempt any explanation of this strange habit. A later observer, Mr. W. H. Hudson, after stating that this habit is only developed among the guanacos of Southern Patagonia, suggests, however, that it is due to an inherited instinct,

derived from a time when the animals were accustomed during a period of exceptional cold to seek refuge beneath the cover of the bushes growing in the sheltered river-valleys. "Once we accept this explanation as probable," writes Mr. Hudson, "namely, that the guanaco, in withdrawing from the herd to drop down and die in the ancient dying-ground, is in reality only seeking an historically-remembered place of refuge, and not of death—the action of the animal loses much of its mysterious character; we come on to firm ground, and find that we are no longer considering an instinct absolutely unique, with no action or instinct in any other animal leading up to or suggesting any family likeness to it."

Llama.

With the true llama (*L. glama*) we come to the first of the two domesticated representatives of the genus, both of which are now considered to have originated from the wild guanaco. The llama attains larger



THE LLAMA (1/8 nat. size).

dimensions than the guanaco, and is very variable in colour, although generally white, or white spotted with brown or black, and more rarely completely brown or black. The skull is very similar to that of the guanaco, and the knees have the same naked patches. In general appearance the llama is a long-necked and long-limbed

creature, with comparatively short hair falling but little below the lower line of the body. It was bred by the ancient Peruvians mainly as a beast of burden, or for riding, and was chiefly characteristic of the southern portion of Peru, where, before the Spanish conquest, enormous numbers of these animals were kept. The introduction of horses and mules has, however, gradually led to the displacement of the llama as a beast of burden. When, however, llamas and alpacas were the only domesticated Ungulates in South America, their importance to the Peruvians was fully as great as is that of the reindeer to the modern Laplander, since between them they not only did all the carrying work of the country, but likewise supplied their masters with wool and flesh. The complete distinction between llamas and alpacas from as far back as tradition or records extend, coupled with the extreme antiquity of the Peruvian civilisation, indicates that the domestication of the wild guanaco must in all probability have taken place at a very early period. As showing the security of the country it may be mentioned that, soon after the Spanish conquest, it was not uncommon to meet droves of from three hundred to five hundred or even one thousand llamas, each laden with silver ingots, and the whole in charge of a single native. Such droves slept in the open fields without the slightest danger from loss by robbers. Only the male llamas were used as beasts of burden, while the smaller females were kept for their milk and flesh. In travelling along the roads the droves marched in single file, under the guidance of a leader; and such a line would traverse the highest passes of the Cordillera, and skirt the most stupendous precipices with perfect safety. When not in active use, the herds of llamas were kept on the higher mountain-pastures, where they would often temporarily associate with wild guanacos. The Spanish conquerors of Peru spoke of llama-flesh as being fully equal to the best mutton, and they established in the towns shops for its regular sale. At the period of the conquest it is estimated that upwards of three hundred thousand llamas were employed in the transport of the product of the mines of Potosi alone. Llamas produce only one offspring at a time, so that their rate of increase is not very rapid. Usually the young are suckled by the mother for about four months, but in one race the period is longer; and it is stated that the young of two successive seasons may not unfrequently be seen suckling at the same time.

Alpaca.

The alpaca (*L. pacos*) is a considerably smaller animal than the llama, and is bred for the sake of its wool, which is of great fineness and length, reaching in some specimens almost to the ground. The usual colour of the wool is very dark brown or black. In regard to the origin of the alpaca, Mr. Thomas has come to the conclusion that the old view of the vicunia being the parent-stock is untenable, and that we must look to the guanaco as the true ancestor. He observes, for instance, that the size of the alpaca, "although less than that of the llama, is far greater than that of the vicunia. Its skull and teeth wholly agree with those of the former, and the naked patches on the legs, so distinctive of the guanaco as compared with the vicunia, are very often, although not always, present, the exceptions being easily explainable in the case of an animal bred and selected for generations solely with an eye to the thickness and extent of its furry covering. The occasional growth of the fur over the naked patches is not therefore to be wondered at. The probabilities also are much in favour of the

Peruvians having domesticated one wild species only rather than two, and of their having gradually developed two races out of it—the one large, strong, and suitable for the carriage of burdens, and the other smaller in size, but exceptional in its capacity for producing a quantity of useful wool."

Uses. Alpacas are kept throughout the year in large herds on the high plateaus of Bolivia and Southern Peru, and are only driven down to the villages at the shearing-season. The wool is of two kinds—a longer and coarser, and a finer and shorter; the former being termed by the Peruvians

THE ALPACA ($\frac{1}{15}$ nat. size.)

hanaska, and the latter *kumbi*. The Incas dyed both kinds with bright and lasting colours, and wove them into cloth and blankets; and alpaca wool has been introduced into England, the late Sir Titus Salt having established mills for its manufacture into cloth at Bradford.

Acclimatisation. Attempts have also been made to acclimatise the alpaca in Europe and Australia. A large herd was imported by a late Earl of Derby and established at Knowsley, and it was thought that these animals might be successfully introduced into the highlands of Scotland; but if the attempt was ever made, it had no permanent results. In Australia, after great difficulties in

getting permission from the Peruvian and Bolivian Governments for the export of such a large number, three hundred head were introduced, but in five years these had dwindled down to a dozen, and the experiment does not appear to have been repeated. Probably one of the great difficulties to be contended with in the successful introduction of llamas into other countries would be to find a locality where they could be left almost to themselves, and yet where they would be safe. The climate of Britain is doubtless far too damp for them, and in this respect parts of Australia would be much more suitable.

The alpaca goes with young eleven months, and produces but one at a birth. Its flesh is as excellent as that of the llama.

Extinct Camel-Like Ungulates.

It has already been mentioned that extinct camels occur in India and Northern Africa, while fossil species of llamas—some as large as camels—are found in eastern South America. In addition to these, the Pliocene and Miocene formations of the United States have, however, yielded the remains of a number of extinct genera of camel-like Ungulates, from which both camels and llamas have probably been derived; and as no such forms have hitherto been discovered in Europe, we may probably regard North America as the original home of the family, from which the modern representatives have migrated southwards across the Isthmus of Darien, and westwards over Behring Strait into Asia. In the older Tertiary formations of Patagonia the group is unknown.

Some of these North American Pliocene types, like *Procamelus*, were not unlike existing members of the family, but had four premolar teeth in each jaw. In the Miocene we come to still more generalised forms, having the typical number of forty-four teeth (that is to say, with three pairs of incisors in each jaw), while one kind (*Poëbrotherium*), which was no larger than a fox, had the main metacarpal and metatarsal bones of the feet separate, and also showed traces of the bones of the lateral toes. From this form a transition can be traced to others with four complete toes and bunodont[1] molar teeth; and we thus reach the important conclusion that camels and llamas were derived from pig-like animals quite independently of the true Ruminants.

[1] The meaning of this term is explained in the next chapter.

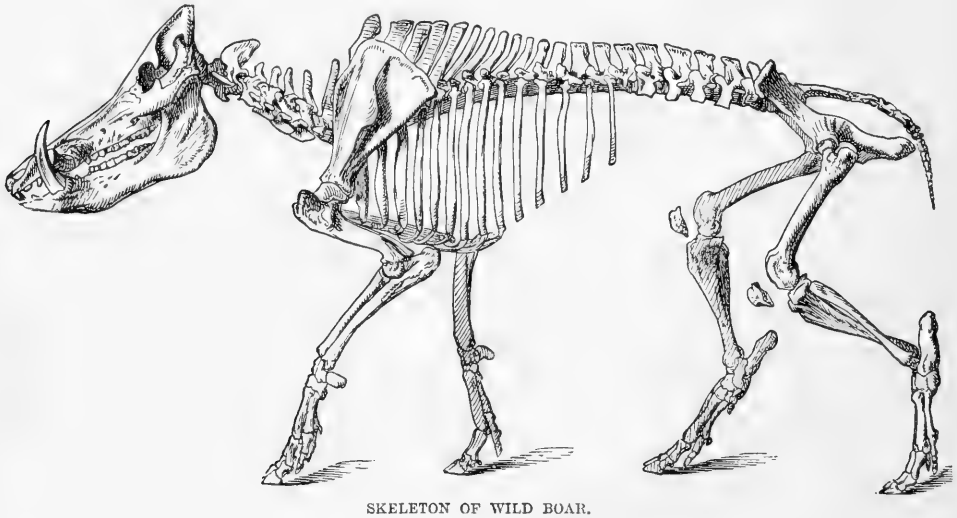
CHAPTER XXV.

UNGULATES,—*continued.*

THE PIG-LIKE UNGULATES.

Family *SUIDÆ.*

THE whole of the even-toed Ungulates described in the five preceding chapters are characterised by their power of ruminating, with which is associated their crescent-like, or selenodont, molar teeth (see figures on p. 155), and, with but one exception, the presence of a cannon-bone in the limbs (see p. 154). We now come to more



SKELETON OF WILD BOAR.

generalised forms of the same great group of Ungulates, such as pigs and hippopotami, which lack the power of rumination, and in which the structure of the molar teeth and lower portion of the limbs is of different nature.

Extinct Links.

At the present day there is a great gap between the types with crescent-like molars and the pig-like animals; a gap so wide that the earlier naturalists failed to recognise the intimate relation that really exists between the two. This gap is, however, almost completely bridged over by a number of extinct Ungulates, and since, in order to have any adequate idea of the relations of the existing groups, some knowledge of the fossil forms is absolutely essential, we must devote a brief space to their consideration.

First, with regard to the molar teeth. On p. 155 there is figured an upper molar of a modern Ruminant, showing that the crown is surmounted by four

crescentic columns of great height, and separated by deep pocket-like pits, while on the same page there is also represented the corresponding tooth of an extinct Ungulate, in which the same columns, although still crescent-like, are very much lower, and are separated by quite shallow valleys, of which the base is visible from the surface. Now from such a tooth there is but a step to the teeth represented in the woodcuts on the present page, marked 1 and 2. It will be observed, however, that the front inner column of the Ruminant molar is here divided into two moieties (*pl. p*), so that the tooth becomes five-columned. The molar represented in Fig. 1 is that of the anoplothere, a two or three-toed Ungulate from the upper Eocene rocks of Europe, furnished with the full number of forty-four teeth. The one marked 2 belongs to the so-called *Hyopotamus*, which also occurs in the upper Eocene rocks. It will be noticed that the columns of the latter, although very low, still have an imperfect crescentic shape; but in the allied anthracothere

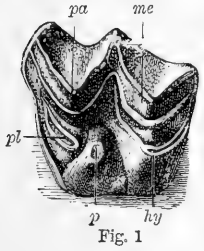


Fig. 1

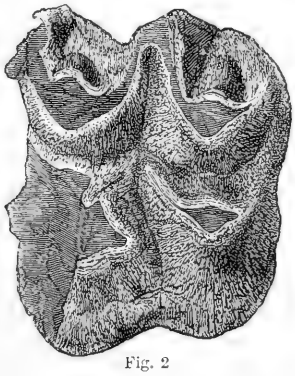


Fig. 2

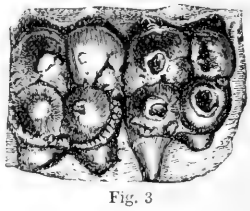


Fig. 3

LEFT UPPER MOLAR TEETH OF EXTINCT PIG-LIKE ANIMALS.

1, Anoplothere (after Gaudry); 2, Hyopotamus; 3, Hyothere. (The specimen represented in the second figure is imperfect on the anterior side).

of the same horizon this structure is far less apparent, and the columns assume the form of flattened cones. From such a tooth the transition is easy to the type of the pair marked 3 in our illustration, which belonged to an extinct pig known as the hyothere. In the latter figure it will be seen that each tooth carries four low, conical, hillock-like columns, or tubercles, the column marked *pl* in the molar of the anoplothere having almost completely disappeared. From the hillock-like form of the columns the type of tooth found in the pigs is known as the bunodont (Gr. *bounos*, a hillock) form, in contradistinction to the selenodont (Gr. *selene*, the crescent-moon) form distinctive of all the ruminating Ungulates. This essential distinction in the structure of their molar teeth is the most readily recognised characteristic by which the pig-like Ungulates are distinguished from all those treated in the preceding chapters; but from the transition between one type and the other indicated by extinct forms, it is perfectly clear that the true Ruminants, the chevrotains, and the camels, are all severally descended from bunodont ancestors.

Characters of Pigs. The pigs and their allies are further distinguished from the true Ruminants and camels, by the metacarpal and metatarsal bones of the two main digits of the feet remaining distinct instead of being fused into a cannon-

bone, while in the fore-limb at least the lateral toes are likewise furnished with complete metacarpals, as shown in the accompanying figure. In these respects the pigs are, however, approached by the water-chevrotain (p. 401); and they also resemble all the chevrotains in having a conical process on the front of the second vertebra of the neck for articulation with the first of that series.

THE BONES OF THE LEFT FORE-FOOT OF THE PIG. (From Dawkins.)

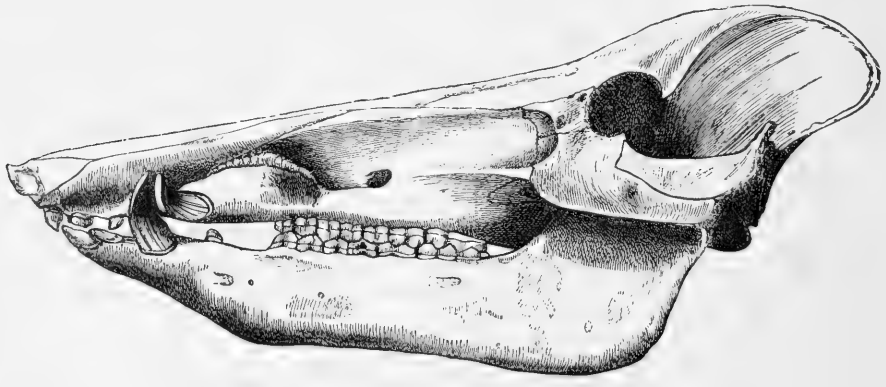
All members of the pig-like group—technically known as the *Suina*—have front or incisor teeth in their upper jaws, and their lower tusks are quite unlike, and distinct from the incisors. Further, in correlation with the absence of the power of rumination, the stomachs of these animals are always less complex than those of the Ruminants, and they may be perfectly simple, and comprise only a single chamber. It is, perhaps, well to add that pig-like animals existed at a date when Ruminants were unknown, as, indeed, must necessarily have been the case if the one group be the ancestor of the other.

With these introductory remarks as to the characteristics of the members of the group, and their relationship through extinct forms with the Ruminants, we may proceed to the consideration of the existing pig-like Ungulates, which are divided into the three families of the Pigs, the Peccaries, and the Hippopotami.

The Pigs.

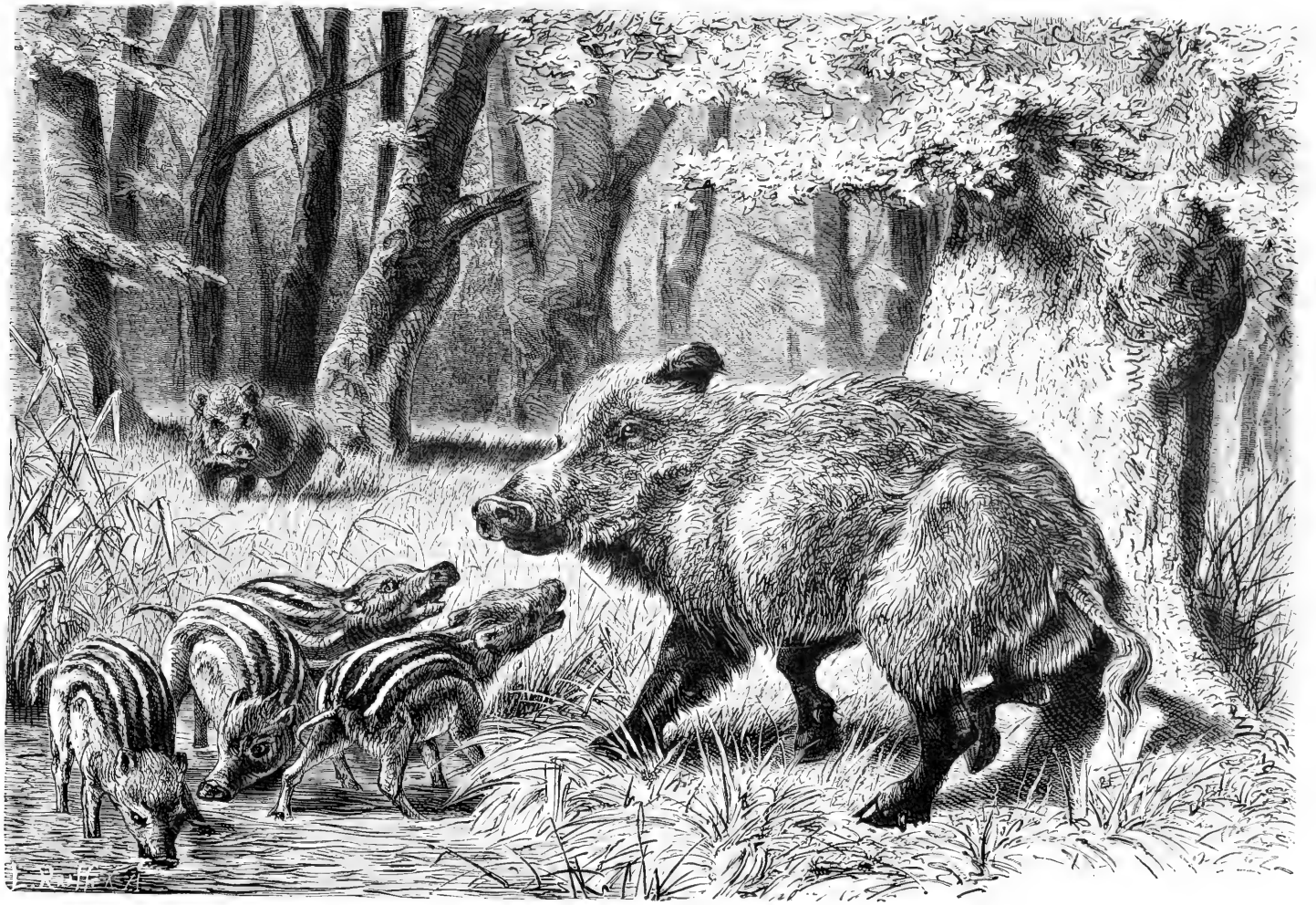
Family *Suidæ*.

The pigs, or swine, of which there are three existing generic types, are such well-known animals that but little description is necessary. They are, however,



SKULL OF THE BEARDED PIG. (From Nehring.)

distinguished from the other members of the group to which they belong by the following assemblage of characters. The head and skull are greatly elongated, and the muzzle terminates in an abruptly-truncated mobile snout, with a disc-like



A FAMILY OF EUROPEAN WILD SWINE.

naked surface at the extremity, in which are situated the nostrils, the disc being supported by an additional separate bone at the extremity of the skull, as shown in our figure. The feet are narrow, and carry four completely-developed toes, of which the hindmost do not touch the ground in walking, while the inner surfaces of the main pair are flattened. The molar teeth are narrow, the last one in both the upper and lower jaw being more or less elongated; and the large tusks grow continuously throughout life, those of the upper jaw curving upwards, instead of pointing downwards, after the usual fashion. Swine have large flapping ears, and rather long cylindrical tails, with a tuft at the end. Their bodies are more or less sparsely clothed with bristly hairs, and their stomachs are quite simple. Like all unspecialised Ungulates, swine have the neck short and thick, and imperfectly differentiated both from the body and the head, the latter being consequently carried low. The whole of the existing members of the family are restricted to the Old World; and they chiefly frequent damp or swampy districts, and are fond of wallowing in wet mud.

THE LAST RIGHT LOWER MOLAR TOOTH OF A PIG.

The True Pigs.

Genus *Sus*.

The typical representatives of the Pig family, such as the European wild boar, are characterised by having forty-four teeth, among which the last molar in each jaw is greatly elongated, while the thick and short upper tusk is turned sharply upwards, and has a large smooth facet worn on the outer side of its upturned extremity by the abrasion of the inner surface of the extremity of the lower tusk. Consequently, if either tusk happens to be broken, the opposing one continues to grow indefinitely, and, from its curved form, generally pierces some portion of the skull with its tip, thus ultimately leading to the death of the animal which has had the misfortune to meet with an accident of this nature. In addition to the bristly hairs, there is generally a more or less developed woolly under-fur. The skull of the pigs, besides the presence of the additional bone in the snout already mentioned, is remarkable for the great length of the nasal bones, and also for the high elevation of the crest of the occiput, which is generally even more developed than in the specimen figured here. In wild pigs the profile of the face is straight, although in most domesticated races it is more or less concave. Pigs are exceedingly prolific animals; and the young of all the wild species (as shown in our illustration) are marked with light longitudinal stripes, although these markings are very rarely observed in those of domesticated breeds.

Distribution. The distributional area of the genus, before curtailed by human agency, was extensive, comprising the greater part of Europe, Southern, and a portion of Central, Asia, Japan, the islands of the Malayan region, and Africa. The two species inhabiting Africa south of the Sahara

and a third from Madagascar, belong, however, to a group distinct from that including the rest. Domesticated pigs have been turned loose in many parts of the world, such as America, the West Indies, and New Zealand, where they have formed feral races tending to revert more or less completely to the wild type, some even producing striped young.

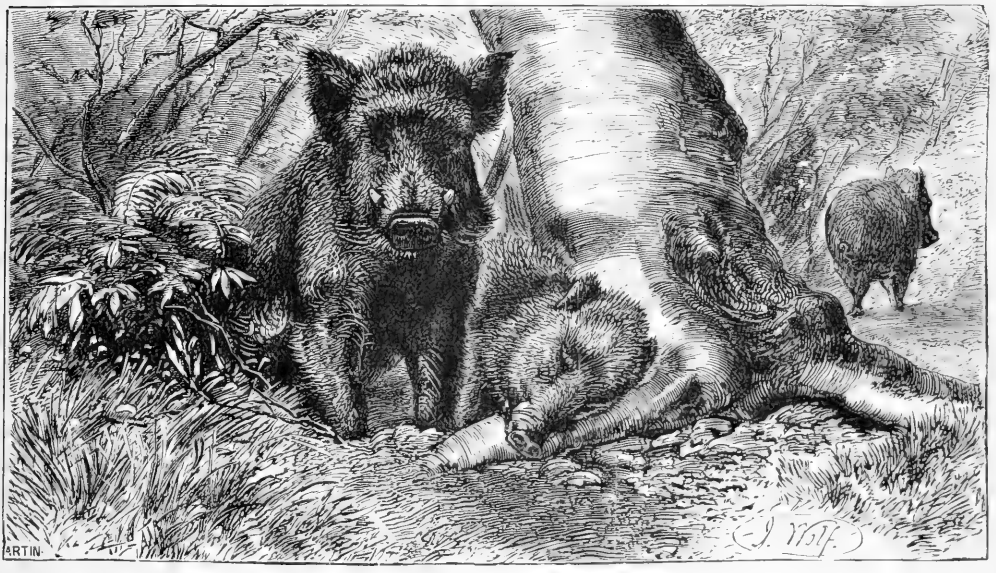
Species. Although some of the species are markedly distinct, the pigs (exclusive of those from Southern Africa) are an exceedingly puzzling group, scarcely any two zoologists being in accord as to the number of existing species. Some of the most important distinctive features are afforded by the cheek-teeth; but as such differences, after all, are but slight, and difficult to recognise, we shall, in the main, confine our attention to some of the better-known species, such as those of Europe and India.

European Wild Boar. The type of the genus is the European wild pig, or wild boar (*Sus scrofa*), ranging over Europe, Northern Africa, and part of Western and Central Asia. In Asia, it is believed by Mr. Blanford to extend into Mesopotamia, Persia, Baluchistan, and Afghanistan, while northwards it ranges to the neighbourhood of Yarkand. It was formerly abundant throughout the British Islands, as is attested not only by historical evidence, but also by the abundance of its remains in the peat-mosses and fens; and boar-hunting was a favourite pursuit of our ancestors. Although the exact date of the extermination of wild boars from the British Islands does not appear to be ascertained, Mr. J. E. Harting has shown that they still existed in Oxfordshire in the year 1339, in Suffolk in 1572, and in Chartley Forest, Staffordshire, as late as 1593; and it is quite probable that in Scotland, and perhaps in Ireland also, they may have lingered on till a still more recent date. In many parts of the Continent, and especially in the Black Forest, wild boars are still abundant.

Indian Wild Boar. The Indian wild boar (*S. cristatus*) is so closely allied to its European cousin that it is frequently regarded as specifically inseparable. It is, however, a somewhat taller animal, with a thinner coat of hair and no under-fur; but it is more especially distinguished by the presence of a crest or mane of long black bristles running from the nape of the neck along the back, and by the more complex structure and larger size of the last molar tooth in each jaw. As regards the latter characteristic, it may be observed that in the European wild boar the hindmost of the three lobes constituting the last lower molar, is not more complex than in the specimen figured on p. 425; but in the Indian species, and more especially in the males, this lobe (the one on the left of the figure) is complicated by the addition of one or more extra tubercles to the hinder extremity, thus making the whole of this tooth considerably longer and more complex. Analogous but less strongly-marked differences may be observed between the corresponding upper teeth of the two species. The usual height of the Indian wild boar varies from 30 to 40 inches at the shoulder, but it is stated that one specimen has been killed standing upwards of 43½ inches; while the weight ranges from 200 to considerably over 300 lbs. When extracted from the jaw, the lower tusk of a fine boar will measure somewhere about 8 or 9 inches in length; but specimens measuring 9¼ and 10 inches have been recorded, and one is said to have been obtained

which measured upwards of 12 inches. The Indian wild boar is found in suitable spots throughout India, Ceylon, and Burma, and also in the wooded districts of the outer Himalaya, extending into the interior as far as Kashmir.

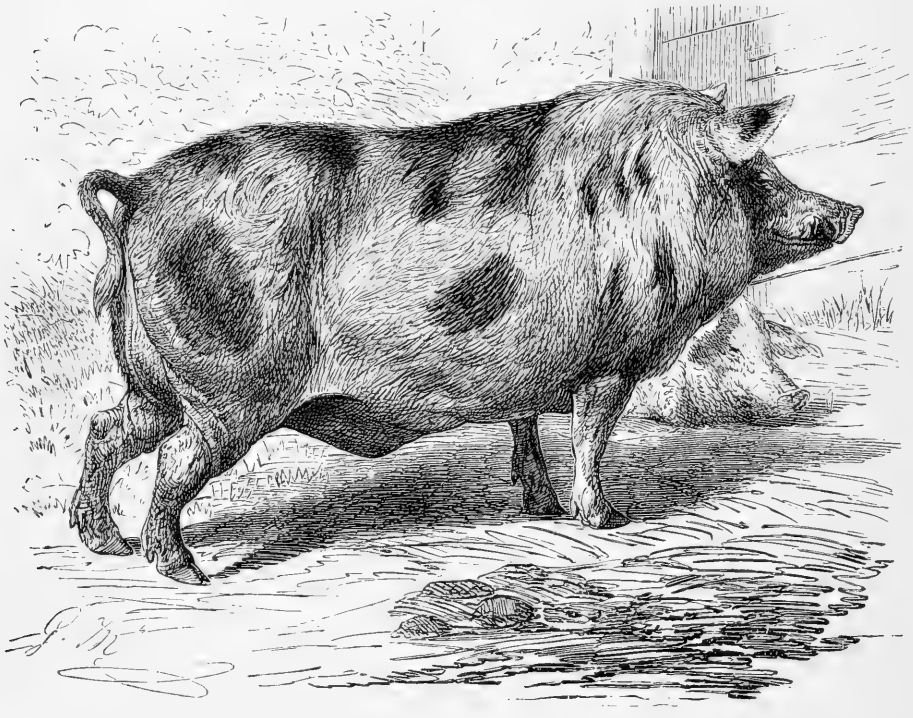
Habits. Since the habits of all swine are very similar, while those of the Indian wild boar are best known to Englishmen, we may give an account of them in this place. As we have said, pigs generally frequent moist or marshy situations, where there is plenty of cover, and their great characteristic is their habit of turning up the ground with their snouts in search of food, leaving marks by which their presence in a district can be instantly recognised. It is this habit which renders these animals so especially obnoxious to the cultivator. During the day the Indian wild boar makes his lair in any convenient cover, sometimes in tall grass, at others in reeds or sugar-cane, and



A "SOUNDER" OF WILD SWINE.

at others in bushes or forest, while not unfrequently standing crops other than sugar-cane afford the necessary shelter. In the mornings and evenings he wanders forth in search of food, in cultivated districts devastating the crops, but away from human haunts he depends chiefly upon roots, those of a kind of sedge being especial favourites. Wild pigs will, however, readily feed on the carcases of animals and other carrion, while in Assam they are stated to be in the habit of digging out the fish which bury themselves in the mud during the dry season. According to Mr. Blanford, pigs are less nocturnal in their habits in remote districts than in those where they are much disturbed. While the females and young associate in droves or "sounders," usually comprising from ten to a dozen head, and rarely exceeding twenty, the old boars are solitary. The number of young produced at a birth by the European species varies from six to ten, after a gestation of four months; and frequently at least two litters are produced in a year.

The lower tusks of the male wild boar, which project about 3 inches from the jaw, and are kept with edges as sharp as razors by wear against those of the upper jaw, are most formidable weapons, capable of ripping open a horse at a single stroke. Both the European and the Indian species are among the boldest and fiercest of all animals, charging men, horses, or elephants time after time without a moment's hesitation, and in spite of the most desperate wounds. Indeed, the injuries that a wild boar will sustain without loss of life are perfectly marvellous. A correspondent of the *Asian* newspaper relates that he once killed an old boar, in the skull of which the broken extremity of the tusk of another



BERKSHIRE PIG ($\frac{1}{10}$ nat. size).

boar was firmly embedded, with its point penetrating into the brain-cavity a short distance behind the left eye.

Although the speed of a wild pig is considerable, yet it cannot be maintained for any long distance, and accordingly, either a boar or a sow may be easily overtaken by a well-mounted horseman after a comparatively short run. Both as regards speed and inclination to fight there is, however, considerable local variation among the wild pigs of India; the large heavily-built animal found in Bengal being much more disposed to show fight than the lighter pig of the Punjab, which has a greater turn of speed. In spite of its boldness, the Indian wild boar seldom makes unprovoked attacks; but when once roused nothing will stop it. An instance is on record of a boar charging, overthrowing, and ripping open a camel; and there are several well-authenticated cases of boars having attacked and killed or beaten off tigers.

Hunting. In Germany the European wild boar is hunted with boarhounds; and when in the highlands of Ceylon Sir Samuel Baker was in the habit of hunting the Indian pig with a pack of dogs, and despatching his quarry single-handed with a hunting-knife. In all parts of India where riding is possible the wild boar is, however, always speared; and the sport of "pig-sticking," as it is commonly called, is undoubtedly by far the finest and most exciting of all the many kinds of Indian *shikar*. One of the best grounds for pig-sticking is the old valley of the Ganges in the neighbourhood of Mirut, locally known as the *Khadir*. Here "the ground," writes General Kinloch, "consists of level plains covered with grass and intersected with deep *nullas* or ravines, some dry, others full of water; with deep but invisible ditches; holes varying in size, from pits large enough to swallow up horse and rider to others just big enough to admit a horse's leg; hidden stumps, and tangled bushes; and over this one has to gallop at racing pace." Falls are of course frequent, although severe accidents are less common than might have been expected.

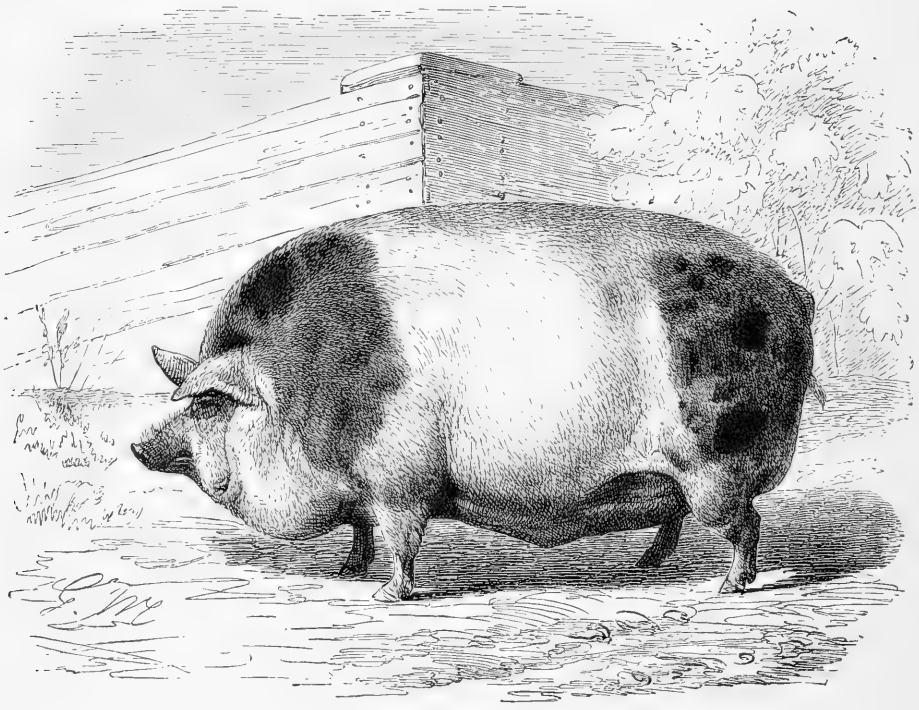
Andaman Pig. A smaller species of pig inhabits the forests of the Andaman Islands in the Bay of Bengal, and stands only some 20 inches in height at the shoulder. In addition to its small stature, the Andaman pig (*S. andamanensis*) is further distinguished by its relatively short tail, the shagginess of the coat, the absence of the crest of long hair on the neck, and, above all, by the relative shortness of the hindmost lobe of the last molar tooth in the lower jaw. The third Indian representative of the genus is the pigmy hog (*S. salvanius*), of the forests at the foot of the Himalaya in Bhutan, Sikhim, and Nipal. These tiny little pigs are scarcely larger than hares, standing only about 11 inches at the shoulder. They are brown or blackish brown in colour, with small, naked ears, very short tail, and only three pairs of teats in the female instead of the usual six. From the little that is known of the habits of these pigs in the wild state, it appears that they generally live in herds of from five to twenty head in grass-jungle, and that the old boars remain with the sows. Probably the number of young produced at a birth is less than in other pigs.

Pigmy Hog.

Malayan Pigs. We have now to consider briefly the wild pigs of the islands of the Malayan region and Japan; and it is among these that the greatest uncertainty prevails among zoologists, as to the real number of species discoverable. These pigs may, however, be divided into three groups, of which the first is nearly related to the Indian pig. The best known representative of the first group is the collared pig (*S. vittatus*) of Java, Sumatra, and Borneo, characterised by the white streak running along the sides of the face to the neck, and by the absence of any crest of hair on the back of the neck, and of warts on the face; the last lower molar tooth being large and complex. The white-whiskered Japan pig (*S. leucomystax*), as well as the Papuan pig (*S. papuensis*), and the Formosan pig (*S. taëvanus*) are nearly allied species. The second group is represented by a well-marked species known as the warty pig (*S. verrucosus*), from Java and Borneo, readily distinguished by the presence of three small warts on each side of the face, the largest of these carrying a number of bristles and being situated just below the eye. The skull in this pig is of ordinary length: while the last lower molar tooth is of medium size and complexity. The Ceram

pig (*S. ceramensis*) and the Celebes pig (*S. celebensis*) belong to this group. Lastly, we have the bearded pig (*S. barbatus*) of Borneo, which is markedly distinct from all the others, having a fringe of long hairs on the cheeks, an extremely elongated skull (shown in the figure on p. 422), and the last molar tooth in the lower jaw relatively short, and of simple structure. The great elongation of the skull is shown by the circumstance that the first cheek-tooth of the upper jaw is separated by a considerable interval from the tusk, whereas in other species the two are placed close together.

Since there is nothing in the habits of these pigs to distinguish them from the Indian wild pig, we may pass on to the consideration of some of the domesticated



HARRISON PIG ($\frac{1}{18}$ nat. size).

breeds of swine. It may, however, be mentioned that with the exception of the European wild boar, which ranges into Algeria and the adjacent districts, the only typical representative of the genus found in Africa is the Senaar pig (*S. senaarensis*) of the north-eastern regions of that continent.

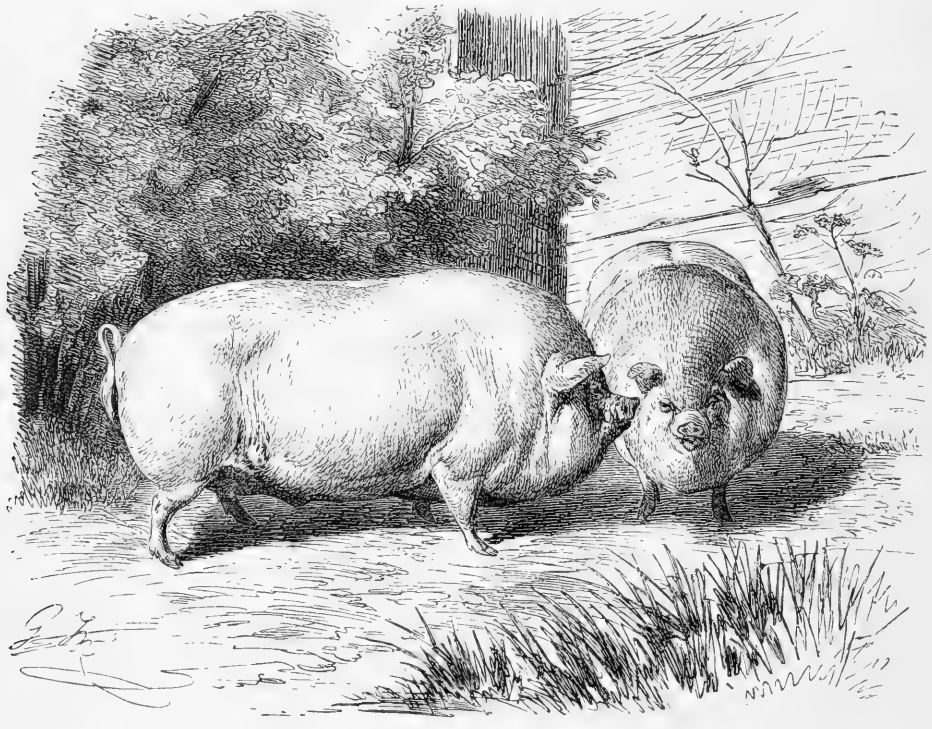
Domestic Swine. Much discussion has taken place as to the origin of the numerous domesticated breeds of swine, and very different views on this subject have been expressed by different writers; some urging that certain of the earlier races found in Europe had an eastern origin, while others regard the whole of them as descended directly from the European wild boar. The earliest evidence of the existence of domesticated swine in Europe is afforded by remains found on the sites of the prehistoric lake-dwellings of Switzerland. These were regarded by Professor Rütimeyer, of Basle as indicating two distinct breeds—one nearly allied

to the European wild boar, and the other more resembling some of the Asiatic kinds. The late Professor Rolleston failed, however, to detect evidence of Asiatic affinity in any of the prehistoric swine of Europe, and accordingly came to the conclusion that they were all probably derived from the European wild species, although these might possibly have some crossing with an Asiatic stock. It must be confessed that this view is, at first sight, the most probable; and that the original domesticated races of different parts of the world have been derived from the wild species inhabiting the same districts. This is the opinion of Mr. Blanford, who states that the tame pig of India is doubtless derived from the wild *S. cristatus*, with which it probably interbreeds. In modern times, however, there has certainly been a great amount of intercrossing between the various breeds of domestic swine; and many of the races now most esteemed in Europe have a large proportion of Asiatic blood in their veins.

The effects of domestication have been very marked on the swine, although the degree of variation from the wild type depends largely upon the amount of care that has been bestowed upon the breed. We have already mentioned that the European domestic breed differs from all wild species by the concave profile of the face; while as a rule domesticated races have uniformly-coloured young. Indeed, whenever the young of domestic swine are striped, a recent crossing with a wild race may not unreasonably be suspected. When domesticated pigs revert to a wild condition, the striping of the young is, however, frequently resumed. Domestication invariably greatly reduces the size of the tusks of the boars, which in some breeds are very small indeed; and in this respect we have a reversion to extinct species of swine, in the earlier forms of which the tusks were but slightly developed. There are also modifications in the form of the hinder part of the skull, in the number of joints in the backbone, and in the length of the intestines. Equally marked differences obtain in the shape of the ears, which in some of the inferior breeds are large, flapping, and pendent, while in the superior breeds they are small and erect. As regards bodily form, we have but to contrast the long-legged, large-headed, and thin-bodied "greyhound pig" of Ireland, with some of the best modern breeds, like the Harrison swine represented on p. 430, to see how enormous is the difference in this respect. Darwin remarks, however, that the observations of Professor Nathusius tend to show "that the peculiar form of the skull and body in the most highly-cultivated races is not characteristic of any one race, but is common to all when improved up to the same standard. Thus the large-bodied, long-eared English breed with a convex back, and the small-bodied, short-eared, Chinese breeds with a concave back, when bred to the same state of perfection, nearly resemble each other in the form of the head and body. This result, it appears, is partly due to similar causes of change acting on the several races, and partly to man breeding the pig for one sole purpose, namely, for the greatest amount of flesh and fat; so that selection has always tended towards one and the same end. With most domestic animals the result of selection has been divergence of character, here it has been convergence."

Domesticated pigs are now found over the greater part of the habitable world; but while those kept in more northern regions are generally confined more or less closely to the homestead, the races of the warmer parts of the world are allowed to

run more or less fully at liberty. Those kept in confinement are generally larger and fatter, although often more delicate animals, than the breeds which are allowed to roam almost at will; the latter being longer-limbed and thinner than the former, but at the same time bolder and more independent in disposition. In Southern Hungary, Croatia, Bosnia, Servia, Turkey, and Spain, the herds of swine are allowed to run in the woods throughout the year, but in less warm districts they have to be taken in and fed during the winter. In the Sierra Nevada of Spain, these herds ascend to an elevation of some nine thousand feet above the sea, and thus become expert climbers.



DWARF CHINESE PIG ($\frac{1}{12}$ nat. size).

European Breeds. The different breeds of European domestic pigs vary so much that it is almost impossible to classify them, and only a few of the more important ones can even be mentioned in this work. Many of the best breeds have been produced by crossing original stocks with the so-called Siamese breed, which is distributed over a great part of the Malayan region, and has been imported into China. This breed (frequently termed *S. indicus*) is characterised by its small size, cylindrical trunk, hollow back, short limbs, and the approximation of the belly to the ground. The colour is generally black, with the skin externally of a rich copper colour, and the bristles are soft; but there is also a white variety. The ears are small and somewhat erect, and the face is short. According to Mr. D. Low, these pigs "are less hardy and prolific than the native races of Europe, and the females do not yield the same quantity of milk; but they arrive very soon at

maturity, they fatten on a small quantity of food, and their flesh is white and delicate." The native breeds of Britain, according to the same authority, may be divided into those of small size, with erect or semi-erect ears; and those with larger bodies and long pendent ears. Nearly all these have, however, been more or less largely crossed with the Siamese, or, as it is often called, the Chinese breed; and the general tendency of modern breeding is towards a reduction in size and uniformity in character. Of the smaller kinds, with short erect ears, one of the most distinct is the Highland breed; these pigs being lean, wiry, greyish animals, of great hardihood, roaming over the Scottish moors almost at will, and doing great harm to game and other birds. Near the sea they will feed on molluscs and dead fish, and their flesh, at all times coarse, then acquires a fishy taste. They are also found in the Hebrides and Orkneys.

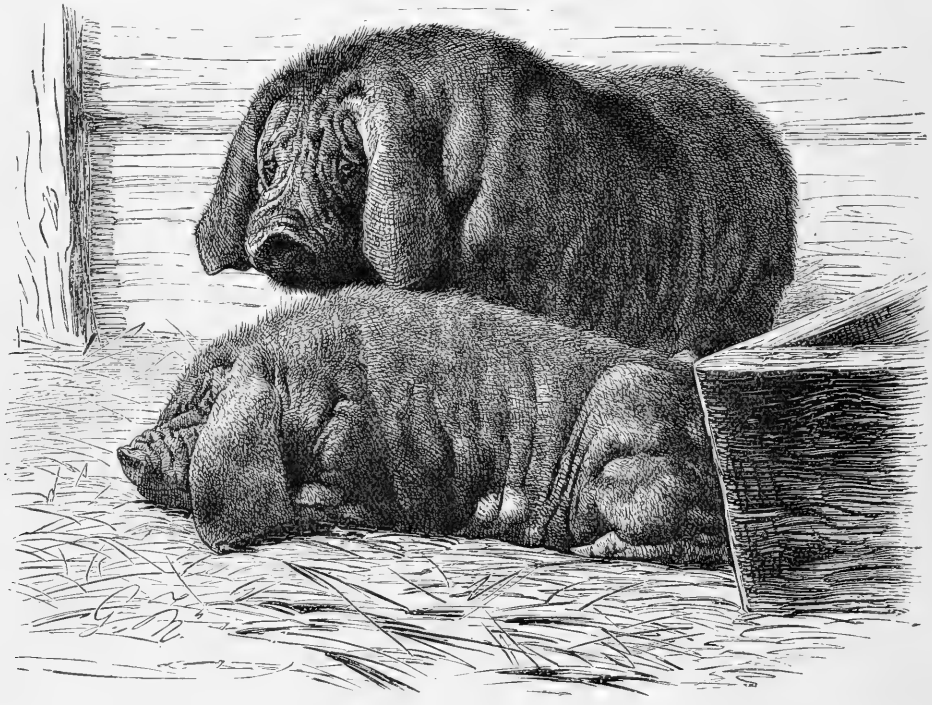
The larger breeds with pendent flapping ears are chiefly characteristic of the lowlands, but few now remain which have not been crossed with foreign blood. In colour they are mostly white, or white spotted with black. They are long in coming to maturity and fatten slowly, but they attain enormous dimensions, and have the advantage of producing large litters, and being excellent mothers. The Yorkshire and Lincolnshire breeds, as well as those of the Eastern counties, are large white pigs, with pendent ears; the Essex breed (which has now been largely crossed with the Chinese) being remarkable for the fineness of the skin and the softness of the bristles. The Hampshire is also a noted breed; while the largest of all is the Rudgwick. One of the most valuable is, however, the Berkshire breed, which is somewhat inferior in point of size. Originally these pigs, as shown in the illustration on p. 428, were generally of a reddish brown colour, with brown or black spots; but by crossing with the Chinese breed, or derivates thereof, the size has been reduced, and the colour changed to black, although, when the crossing has been with the white breed, it is more generally black mixed with white. The original Berkshire, writes Mr. Low, "is still regarded as one of the superior breeds of England, combining size with a sufficient aptitude to fatten, and being fitted for pork and bacon, and it is held to be the hardiest of the more improved races." The Harrison pig, figured on p. 430, is intended to exhibit one of the best types of fattening breeds: while the white dwarf Chinese pig, represented in the illustration on p. 432, exhibits the greatest diminution in size, coupled with an almost completely cylindrical form of body.

It may be observed that although the usual mode of life led by pigs in England is not calculated to develop their intellectual faculties, yet they are by no means deficient in intelligence, and display a remarkable acuteness of scent. Indeed, a pig has been trained to stand to game as steadily as the best-bred pointer.

Masked Swine.

Before taking leave of domesticated swine, we must not omit to mention the curious Japanese masked pig, represented in the figure on p. 434. This pig, writes Darwin, "has an extraordinary appearance, from its short head, broad forehead, and nose, great fleshy ears and deeply-furrowed skin. Not only is the face furrowed, but thick folds of skin, which are harder than the other parts, almost like the plates on the Indian rhinoceros,

hang about the shoulders and rump. It is coloured black, with white feet, and breeds true. That it has long been domesticated, there can be little doubt; and this might have been inferred even from the circumstance that its young are not longitudinally striped." From a study of its skull, Professor Nathusius regards the masked pig as nearly allied to the Chinese breed; but, as Darwin remarks, "if this be really the case, it is a wonderful instance of the amount of modification which can be effected under domestication."

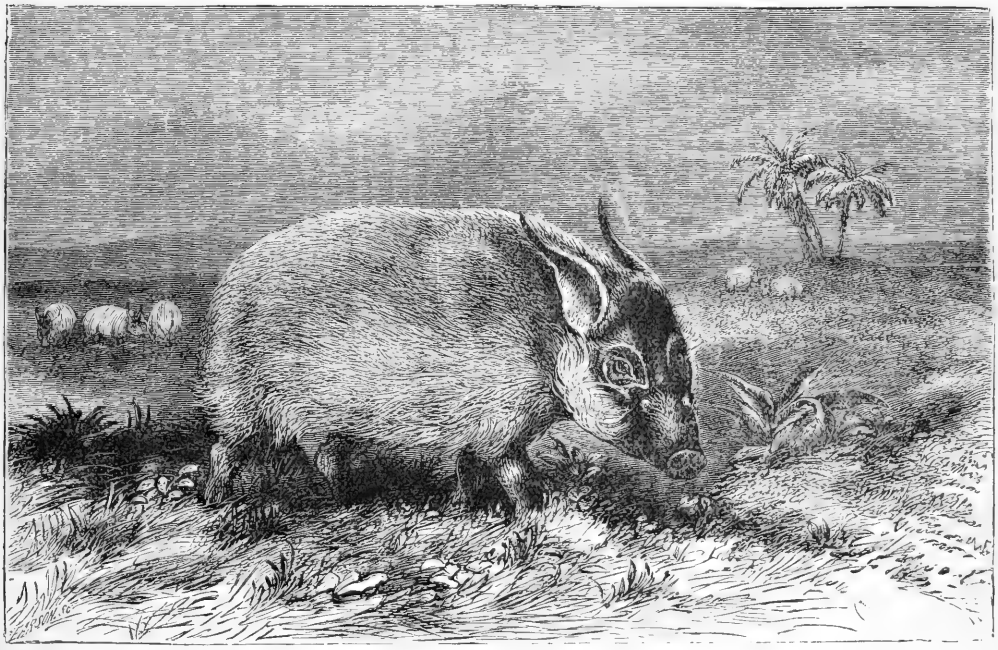


MASKED JAPANESE PIG ($\frac{1}{7}$ nat. size).

Bush-Pigs. The African bush-pigs—the Bosch-Varks of the Cape Boers—differ from the typical members of the genus by always having one pair less of cheek-teeth, owing to the absence of the first premolar on each side of the lower jaw, while frequently the corresponding upper tooth is likewise wanting in the adult. The molar teeth are also distinguished by their simpler structure, the last in the lower jaw having the third lobe much reduced in size. The tusks are scarcely larger than those of domestic pigs, and the snout is unusually elongated. On each side of the face immediately below the eye there is a large swelling, due to the great development of a ridge of bone on the sheath of the upper tusk. The grey bush-pig (*S. africanus*), ranging from South to Central Africa, has the hair of a greyish brown colour, and no pencils of hair on the ears. It generally frequents thick forest, although occasionally found in thorny bush and among reeds in the river valleys. Mr. E. H. Drummond says that "the ingulabi, as it is called by the natives, does an immense amount of damage to their sweet potatoes and fields, and has in

consequence been exterminated in many districts." Its habits appear to be very similar to those of the ordinary swine.

The red bush-pig or river-hog (*S. porcus*) is a rather smaller species than the last, inhabiting West Africa, and distinguished by the long pencils of hairs with which the ears terminate, and also by the brilliant reddish colour of the hair. As in the last species, the bristles of the neck, back, chin, and throat are elongated into a distinct mane, and the tail terminates in a distinct tuft. The prevailing colour is either a shining brownish red with a tinge of yellow, or



THE RED BUSH-PIG.

a dark reddish yellow; the forehead, ears, and limbs are, however, blackish, while the mane on the back, part of the margins of the ears, and the tips of their pencils of hair, the eyebrows, and a streak under the eyes and the margins of the cheeks, are white or whitish. The under-parts are whitish grey, and the snout grey. These brilliant contrasts of colour make the red bush-pig decidedly the handsomest member of the Swine family. These pigs are found in large herds, and frequent moist forests and the banks of rivers, while they are occasionally seen on the mountains. The first living example of this species brought to Europe was exhibited in the London Zoological Gardens, 1852, since which date many specimens have been imported into Europe. A third species (*S. edwardsi*) inhabits Madagascar.

Extinct Pigs. Numerous fossil pigs are found in the Pliocene and Pleistocene Tertiary deposits of the Old World, which may be referred to the genus *Sus*, and several of which differ markedly from all existing species; these fossil pigs occurring in Europe, North Africa, India, and China. One of the most remarkable is the titan pig (*S. titan*) from the Siwalik Hills, at the foot of the

Himalaya. In this monster the length of the skull was 23 inches, against 16 in an average-sized Indian wild pig, so that the height of the animal could not have been much less than that of a fair-sized mule. The same deposits have also yielded remains of an extinct species which did not exceed the living pigmy hog in point of size. Still more noteworthy are Falconer's pig (*S. falconeri*) from the Siwalik Hills, and some allied species from the Pleistocene deposits of Southern India and Algeria, which, in the extreme complexity of the lower teeth, approximated to the under-mentioned wart-hogs. The Auvergne pig (*S. arvernensis*) from the Pliocene of France, is believed, on the other hand, to be related to the African bush-pigs. In most of these extinct species the tusks of the boars, as already mentioned, were relatively small.

The Babirusa.

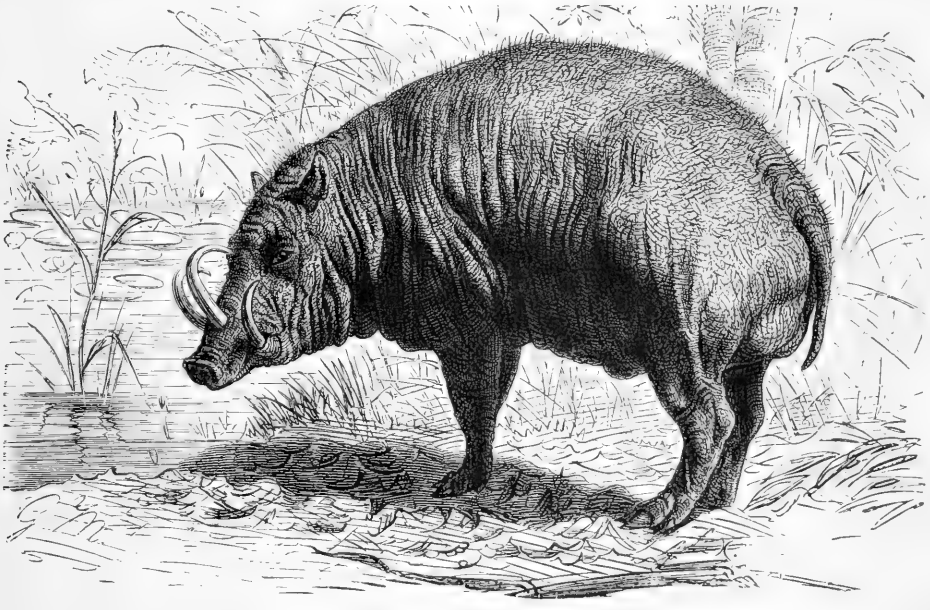
Genus *Babirusa*.

The extraordinary development of the tusks in the males of the animal to which the Malays have given the name of Babirusa (meaning pig-deer) is so remarkable as to suggest at first sight the idea of a malformation. The babirusa (*Babirusa alfurus*), which is an inhabitant of Celebes and Boru, and is the sole representative of its genus, has, indeed, derived its name from these abnormally-developed tusks, which have led the Malays to liken them to the antlers of the deer. In the boars, as is well exhibited in our figure of the skull, the upper tusks, while curving upwards like those of an ordinary wild pig, instead of protruding from the margins of the jaws, arise close together near the middle line of the face, and thence, after being directed upwards for a short distance, sweep backwards, frequently coming into contact with the surface of the forehead, and are then finally directed forwards at the tip. The lower tusks have the same upwards-and-backwards direction as those of the upper jaw, but are frequently less strongly curved, although in other cases the direction of their sweep is not very different from that of the latter. Both pairs of tusks are quite devoid of enamel, and, as there is no abrasion of the one pair against the other, both grow uninterruptedly; the upper tusks occasionally attaining a length of $14\frac{1}{2}$ inches, we believe, exclusive of the portion buried in the socket. In addition to the peculiar conformation of its tusks, the babirusa differs from ordinary pigs in the diminished number of its teeth, of which the total is only thirty-four; the missing teeth comprising the outermost incisors and the first two premolars on each side of both the upper and lower jaws. The molar teeth are characterised by their simple structure and the small development of the third lobe of the last one in each jaw.

The babirusa has a nearly naked skin of a dark ashy grey colour, sparsely covered with hair along the line of the back, and thrown into numerous wrinkles. The ears are small, the tail is short and devoid of a terminal tuft, and the back is much arched. The female has small tusks, and only a single pair of teats. The height at the middle of the back is about 42 inches. The young, of which there are either one or two at a birth, are devoid of stripes.

The peculiar character of the tusks, the reduction in the number of the teeth, and the uniform coloration of the young, indicate that the babirusa is a more specialised creature than the ordinary pigs. At the same time, the simple structure of the molar teeth indicates that it must be directly descended from one of the extinct genera of pigs in which a similar type of dentition obtains.

Habits. The habits of the babirusa seem to be very similar to those of other wild swine; moist forests, cane-brakes, and the banks of rivers and lakes where abundance of water-plants are to be found, being its favourite resorts. Here these animals collect in larger or smaller herds, sleeping by day and going forth to feed at night. The babirusa is an excellent swimmer, not only entering lakes to feed on water-plants, but likewise traversing small channels of



THE BABIRUSA ($\frac{1}{8}$ nat. size).

the sea separating one island from another. Its gallop is lighter than that of the wild boar. The senses of smell and hearing are very acute in the babirusa, and its grunt is very similar to that of other swine. The young are born in February, and of very small size, and require great attention on the part of the sow.

Babirusa are frequently tamed in Celebes, and may be found in the houses of some of the chiefs. The first living examples brought to Europe were a pair exhibited in Paris in the year 1820.

Use of Tusks. Much discussion has arisen as to the use of the tusks of the male babirusa. It has been suggested that they may be for the purpose of protecting the eyes when the animal is rushing through dense forest: but if this were so, as Mr. Wallace points out, how are we to account for the slight development of these organs in the sows. On the whole, the same observer considers it most probable that the tusks were at one period useful to their owner, and were

then kept of moderate size by mutual attrition, but that, for some reason or other, they have become of no benefit to the animal, and have assumed a monstrous growth like that occurring in the lower tusk of a wild boar when the corresponding upper one has been accidentally broken off.

Hunting.

The natives of Celebes organise carefully-planned hunts for the capture of the babirusa, an account of one of these being given by Dr. Guillemard in the following words:—"The animals being driven into a *curral*, with a V-shaped opening and flanked by netting, we had plenty of time to wait before the sport began, and meanwhile the natives arranged themselves at their posts. One stood at the door of the curral, ready to close it directly any animal rushed in; others took up their places on either side of the wide entrance, while the remainder crouched in front of the long net at intervals of a few yards, each grasping his spear, and hidden from view by a huge Livistonia (a kind of palm) frond. We had not long been settled before a peculiar barking grunt in the distance announced the arrival of the first victim. Everyone was instantly motionless, and directly afterwards a dark object dashed up at great speed and buried itself in the net a short way down the slope. There was a short struggle, and in less than five minutes the captive, a full-grown female babirusa, was quietly reposing on her back, with her legs tied together with rattan, and we were once more in ambush for the next comer. We were hardly quiet before the same peculiar sound was heard rapidly approaching, and the next moment a magnificent old boar babirusa rushed past within five yards of us, and plunged into the net between our tree and the entrance to the curral. His long tusks became entangled in the meshes, and the natives ran up to spear him. Just at this moment, however, he broke loose, and, turning on his antagonists, scattered them in all directions. It was a most determined charge, and, as we were unable to fire for fear of hitting some of our own men, it might have proved a serious affair for the native he singled out." After some trouble the animal was, however, finally despatched with a spear-thrust; but, "even with four spears buried in his body, the old boar died game, striving to the very last to get at his antagonists."

SKULL OF BABIRUSA. (From Guillemard's *Cruise of the Marchesa.*)[1]

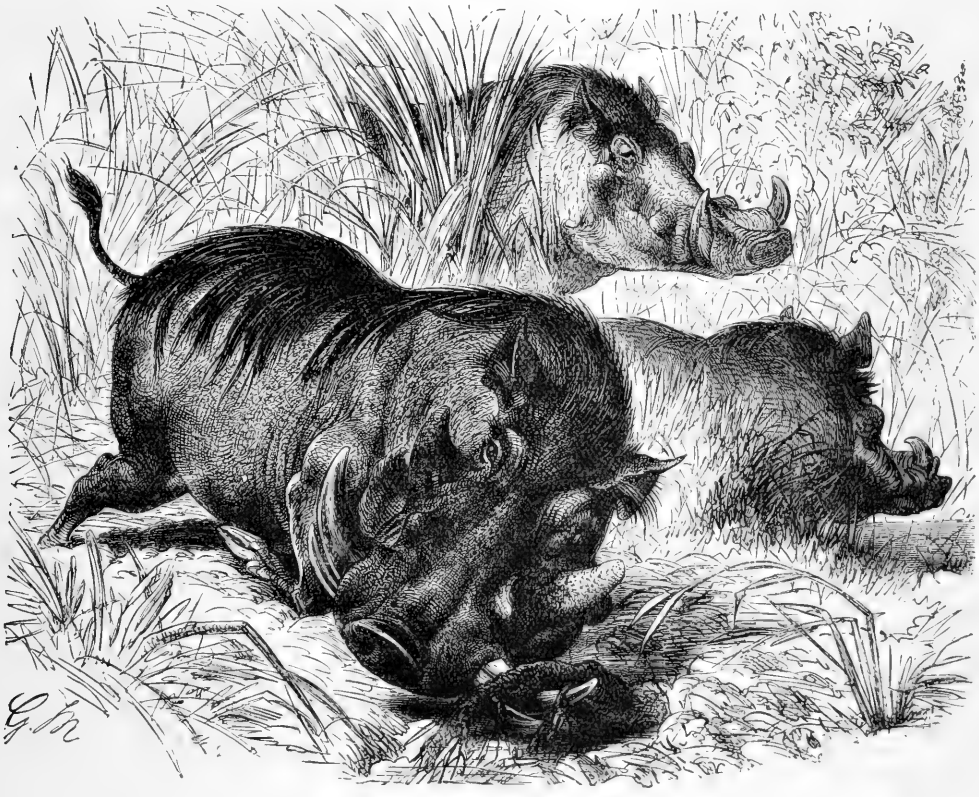
[1] We are indebted to Mr. Murray and the author of the book named for the use of this figure.

The Wart-Hogs.

Genus *Phacochœrus.*

As Africa possesses in the red bush-pig the handsomest representative of the Swine family, so in the wart-hogs it presents us with the most hideous members, not only of that group, but of the whole Ungulate order.

The wart-hogs, of which there are two nearly allied species, are characterised by the enormous size of their heads, in which the lower part of the face is extremely flat and broad, while below each eye is a huge warty protuberance



ÆLIAN'S WART-HOG ($\frac{1}{12}$ nat. size).

between which and the tusk there are two other of smaller size. The head is likewise distinguished by the great length of the muzzle, and the consequent backward position of the eyes: the hideous physiognomy being completed by the huge tusks with which the jaws of both sexes are armed, those of the upper jaw being considerably longer than those of the lower, or just the reverse of what occurs in the true pigs. This difference in the proportionate length of the upper and lower tusks in the two groups is due to the circumstance that in the wart-hogs the lower pair only bite against the inferior surface of the upper ones, instead of abrading their whole summits. The upper tusks are devoid of enamel except at their tips,

and these small caps are worn away at an early period. They curve in an upward and inward direction, and sometimes project as much as $8\frac{3}{4}$ inches from the jaw, having a basal girth of 5 inches. The shorter and more slender lower tusks have a nearly similar curvature, and are coated throughout with enamel.

The tusks are not, however, the only peculiarity in the dentition of the wart-hogs. In young animals there are thirty-four teeth, namely, one pair of upper and three pairs of lower incisors, a pair of tusks in each jaw, and six cheek-teeth on each side of the upper, and five in the lower jaw. In the adult, the incisors and anterior cheek-teeth tend, however, to disappear, till in some instances the tusks and the last molars alone remain, thus leaving a total of eight teeth. This paucity in the number of cheek-teeth is compensated, however, by the enormous size and complex structure of the single molar remaining in each jaw. The tooth in question is composed of a number of small elongated cylindrical denticules, closely packed together; its total length from back to front, being something over 2 inches, and its height proportionately great, although its width is small. This is, however, only an extreme development of the structure already referred to as occurring in certain extinct species of the genus *Sus;* and in possessing such a single tooth on each side of the jaws in the adult condition, the wart-hogs may be compared to the elephants.

The body in these animals is massive and nearly cylindrical, the ears are small and sharply-pointed, the tail is long and tufted at the tip, and the neck and back are furnished with a mane of long bristly hair, the rest of the body being nearly naked. The young are uniformly coloured.

Of the two species, Ælian's wart-hog (*Phacochœrus africanus*) (figured on p. 439) is distributed over a large part of the eastern side of Africa, ranging as far north as Abyssinia. On the other hand, Pallas's wart-hog (*P. pallasi*), of which the head is here figured, is confined to South-Eastern Africa. Both species stand about $27\frac{1}{2}$ inches at the shoulder. The second is distinguished from the first species by its shorter head, which is more convex between the eyes; and it has also the warts below the latter very long and pendent, instead of projecting outwards, while the tusks are more inclined outwards. The mane is also wider and shorter, and there is a greater development of hair on the top of the head and the ears. It has also been considered that it is only this species in which all the teeth, except the tusks and last molars are habitually shed, but this is doubtful. The colour of Pallas's wart-hog is redder than that of its northern relative.

HEAD OF PALLAS'S WART-HOG.
(From Sclater, *Proc. Zool. Soc.*, 1869.)

Habits.

Our accounts of the habits of the wart-hogs are not so full as might be desired, and there is some discrepancy between those given by different observers. The statement made by Heuglin that these animals habitually repose on swampy ground, or even in water, is, however, not borne out by later writers. The northern species is found everywhere in Abyssinia, from the level of the sea at Annesley Bay to heights of nine thousand or ten thousand feet in the highlands of the interior. Mr. Blanford writes, that "its habits are very similar to those of ordinary pigs. It lives amongst bushes or in ravines during the day, and comes out to feed in the evening, still keeping much to bush-jungle. The large males are usually solitary; the younger animals and females live in small herds, apparently not exceeding eight or ten in number. I never saw large 'sounders,' such as are so commonly met with in the case of the Indian hog. It feeds much on roots, which it digs up by means of its huge tusks. It also appears to dig large holes, in which it occasionally lies; these are perhaps intended for the young. Despite its formidable appearance, the Abyssinian wart-hog is a comparatively timid animal, far inferior in courage to the Indian wild hog. Several which I wounded showed no inclination to charge under circumstances in which an Indian pig would certainly have shown fight. The flesh is savoury, but dry and hard, even in comparatively young animals."

The foregoing opinion of the courage of these animals is confirmed by Sir Samuel Baker, who states that it is but rarely that they ever charge. One kept in confinement at Khartum on one occasion, however, broke out from its cage and deliberately charged at Sir Samuel Baker's party, when its rush was effectually stopped by having a huge rhinoceros horn hurled at its head. When brought to bay by dogs, wart-hogs make a determined stand, and inflict severe injuries on their assailants. If excited, they carry their long tails stuck straight upright.

In South-Eastern Africa—where they are known to the natives by the name of Indhlovudawani—wart-hogs, according to Mr. E. H. Drummond, are found on the plains in light thorn-jungles; and they are abundant in the districts around Mount Kilima-Njaro. In those regions they generally occupy the deserted burrow of an aard-vark, or other animal. Mr. Drummond states that wart-hogs, occupying such burrows, "have a most curious mode of exit when they bolt—a dangerous one if you are not up to it. As they emerge from a hole, they turn a somersault on to the back of it, instead of coming straight out like an ordinary animal, and as that is just the spot where one would naturally stand, more than one man has had his legs ripped open before he learnt the wisdom of experience." The same writer mentions that he has on more than one occasion seen a male wart-hog walk deliberately through a pack of large hounds without taking the slightest notice of them, so long as they refrained from biting. Did, however, one bolder than the rest, venture to come to close quarters, the wart-hog with a sudden jerk would either lay its assailant crippled on the ground, or send it howling away.

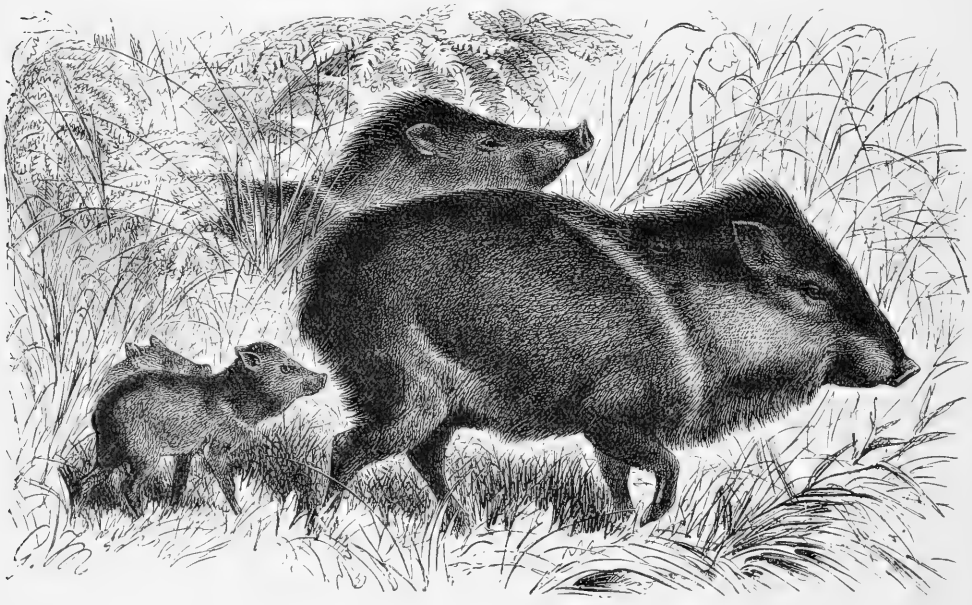
We have no information as to the breeding-habits of the wart-hogs, but from the number of teats in the female being only four, it may be inferred that but few young are produced at a birth. The young are striped.

The Peccaries.

Family *Dicotylidæ.*

The peccaries, which are the American representatives of the swine, differ so markedly from the latter that they are regarded as belonging to a separate family, of which there is but a single genus. The most important differences between the two groups are that the upper tusks of the peccaries have their points directed downwards instead of upwards, that their hind-limbs have three instead of four toes, while instead of the simple stomach of the Old World swine, the peccaries have a complex one approaching that of the Ruminants.

Peccaries have a total of thirty-eight teeth, that is to say, they have a pair of



THE COLLARED PECCARY AND YOUNG (⅛ nat. size).

incisors in the upper jaw, and a premolar on each side of both jaws less than the wild boar. The downwardly-directed upper tusks, which are at first completely covered with enamel, are of small size, with sharp cutting-edges behind; while those of the lower jaw are directed upwards, outwards, and slightly backwards, and are received in notches in the sides of the opposite jaw just in front of the upper tusks. The last molar tooth in each jaw lacks the hind lobe characteristic of the Old World swine (see fig. on p. 421), and the fourth premolar tooth in the upper jaw resembles the first molar in having four tubercles on its crown, instead of only three. In addition to the difference in the number of toes in the hind-feet, the peccaries are further distinguished by the upper ends of the two larger metacarpal and metatarsal bones being united, so that we have here an approach to the formation of cannon-bones. In this respect, as well as in the complex structure of their stomachs, and the presence of four tubercles on their last upper premolar teeth, the peccaries are clearly one step in advance of their allies of the Old World.

An altogether unique feature in these animals is the presence of a large gland in the middle of the back, from which is secreted in great abundance a most evil-smelling oily substance. In appearance, peccaries are not unlike small hogs but with very slender limbs; they are devoid of any externally visible tails, and their snouts are much elongated and extremely mobile. Their ears are small and pointed; and their bodies are covered with thick bristle-like hairs, elongated into a mane on the neck, and forming a fringe on the throat and hind-quarters. The young are uniformly-coloured, like their parents, and never exceed two in number at a birth.

Species. Of the two well-defined species, the collared peccary (*Dicotyles tajacu*) is the smaller, and has the most northerly habitat, its range extending from Arkansas and Texas to the Rio Negro in Patagonia. This species stands from about 13½ to 15½ inches in height at the shoulder. The bristly hairs are parti-coloured, and the general hue of the pelage is blackish brown, becoming yellowish brown mingled with white on the flanks. The under-parts are brown, and the upper part of the chest white, while a broad yellowish white stripe runs from the hinder part of the shoulders obliquely downwards to the chest.

The white-lipped peccary (*D. labiatus*) is a rather larger species than the last, its height at the shoulder varying from 15½ to nearly 18 inches. It is further distinguished by the presence of a large white spot on the lower jaw, and the white lips; the general colour of the hair being greyish black. There is also a difference in the mane and fringe on the neck of the two species. The range of the white-lipped peccary is comparatively small, including only the region lying between British Honduras and Paraguay.

Habits. All peccaries are essentially forest-dwelling animals, but whereas the collared peccary is found only singly or in pairs, or in small parties of from eight to ten individuals, the white-lipped species associates in large herds, of which the members may be numbered by scores. Moreover, there is a marked difference in the disposition of the two species, the former being a harmless and inoffensive creature, whereas the other is comparatively fierce, and not unfrequently inflicts severe wounds with its tusks. Indeed, when a herd of these animals is encountered in the forest, the hunter frequently has to seek protection by climbing a tree. Both species frequent only the densest and most extensive forests, dwelling either in the hollows of trees, in burrows excavated by other animals, or among bushes and grass; and in parts of South America they ascend in the mountains to heights of between 3000 and 4000 feet above the sea. The herds or parties are under the leadership of an old boar. Peccaries wander about both during the day and at night; and when food is scarce they make long migrations in search of it. Their chief food consists of fruits and roots; and their teeth and jaws are of such strength as to enable them to crack with ease the hard seeds of palms. In inhabited districts peccaries inflict much damage on growing crops; and, in addition to roots and fruits, they are by no means averse to varying their diet with carrion, worms, or insects. Their flesh is not much esteemed; and it is essential that immediately the animals are killed, the ill-smelling gland on the back should be removed, as otherwise the flesh will become tainted. As a general rule, but a single young one is produced at a birth, two being comparatively rare.

When taken young, peccaries are easily tamed, although it does not appear that any attempts have been made to establish a domesticated breed. Large numbers of them are destroyed by jaguars and pumas.

Extinct Types. Fossil remains of peccaries, some belonging to living and others to extinct species, occur in the Pleistocene deposits of both North and South America. In addition to these, certain extinct Pliocene and Miocene hog-like animals seem to indicate the parent-stock from which both the peccaries and the true pigs have been derived. Of these *Chærohyus*, from North America, comes closest to the peccaries, while the Old World *Hyotherium*, of which two upper molar teeth are figured on p. 421, is more like the pigs. *Listriodon* is another European type, in which the molars have a pair of transverse ridges instead of four tubercles. Finally *Chæropotamus*, from the upper Eocene of England and France, connects the type of molar tooth characteristic of the pigs with that of the extinct anthracothere referred to on p. 421.

The Hippopotami.

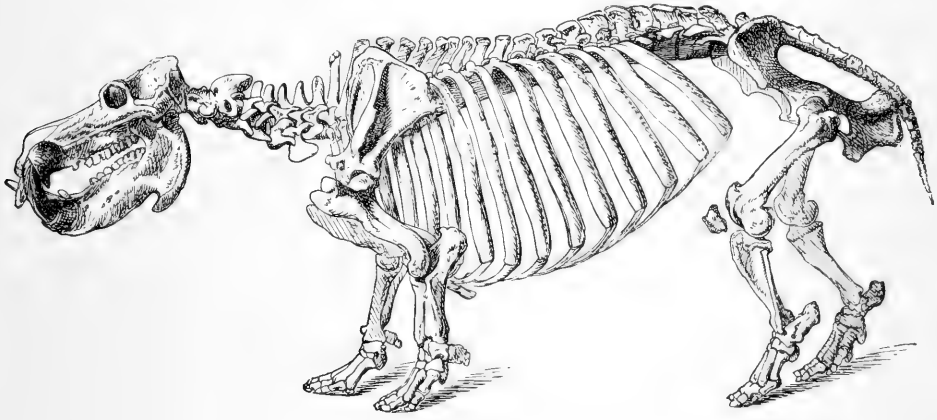
Family *Hippopotamidæ*.

Although the Greek term hippopotamus, and its English equivalent river-horse, are etymologically decidedly objectionable ones to denote the animals we have now to describe, yet the former at least is so firmly established in European languages that it would be impossible to attempt to change it. The Dutch term *see-kuh*, commonly translated sea-cow, but which we think might equally bear the interpretation lake-cow, and a name used by the Arabs which means water-buffalo, are far less objectionable; but a title equivalent to river-swine, which is said to have been conferred on these animals by the ancient Egyptians, is, from a zoological standpoint, far and away the best of all.

The common hippopotamus, together with a much smaller species from West Africa, constitute a family by themselves, which is also the last group of the even-toed Ungulates. Hippopotami are bulky animals, with round, barrel-like bodies of great length, very short and thick legs, and enormous heads, in which the muzzle is angular and greatly expanded transversely, and has no trace of the terminal disc characteristic of the swine and peccaries. Indeed, the ugly head of a hippopotamus appears as if it were too large and heavy for its owner, since the animal may frequently be seen resting its ungainly muzzle on the ground, as though to relieve the neck from the strain of its weight. The portion of the skull in front of the eyes is very much longer than that behind them; and the sockets of the eyes (as seen in our figure of the skeleton) are completely surrounded by a very prominent bony ring, which has an almost tubular form. In the pigs, on the other hand, the socket of the eye is open behind (compare the figure on p. 422). The prominence of these sockets causes the relatively small eyes of the hippopotamus to project far above the level of the forehead. The ears are small and rounded, and the slit-like nostrils are placed rather close together on the highest point of the broad bristly muzzle; while both ears and nostrils alike can be completely closed at the will of the animal. The neck is extremely short and powerful; and the body is so deep,

that when the animal is walking on soft mud, the under surface comes in contact with the ground. Disproportionately short for the size of the animal, the tail is laterally compressed from side to side. The short and broad feet are furnished with four well-developed short toes, all of which touch the ground when walking; and are encased in rounded black hoofs, of which the middle pair have not their inner surfaces flattened; so that the hippopotamus lacks the cloven hoof of the pigs and the Ruminants. The toes of the feet are partially connected by webs. Although there are a number of bristles on the muzzle, and also a few on the sides of the head and neck, as well as at the extremity of the tail, the skin of the hippopotamus is naked; it is also rather rough and warty, and of enormous thickness.

The gigantic mouth of a hippopotamus, when opened to the widest, is one of the ugliest sights imaginable, looking like a huge red cavern, from the edges of which project the enormous tusks and incisor teeth. The tusks, or canines, are the largest of the teeth in the jaws, and are curved backwards in a bold sweep, with



SKELETON OF HIPPOPOTAMUS.

their extremities obliquely bevelled off by mutual attrition; they grow throughout the life of the animal, and their points are directed downwards. The incisor teeth likewise grow during the whole period of existence, and thereby differ from those of the pigs, which form roots. In the existing species, there are not more than two pairs of these teeth, and whereas those of the upper jaw are directed downwards, the lower ones project forward in advance of the jaw. The sides of the jaws are severally provided with seven cheek-teeth, of which the four premolars have subconical pointed crowns, while the broad molar teeth carry four distinct columns, which, when worn by use, show on their summits well-defined trefoil-shaped surfaces of ivory surrounded by a rim of enamel. A peculiarity in the lower jaw of the hippopotamus is the presence of a hook-like flange at its hinder extremity, as shown in our figure of the skeleton.

Summarising the result of the foregoing description, it may be observed that the hippopotami are entitled to rank as a distinct family on account of the following differences from the pigs and peccaries, viz. the broad and expanded muzzle, not terminating in a disc; the subequal size of the hoofs, all of which touch the ground, and the absence of flattening in the opposing surfaces of the middle pair; the

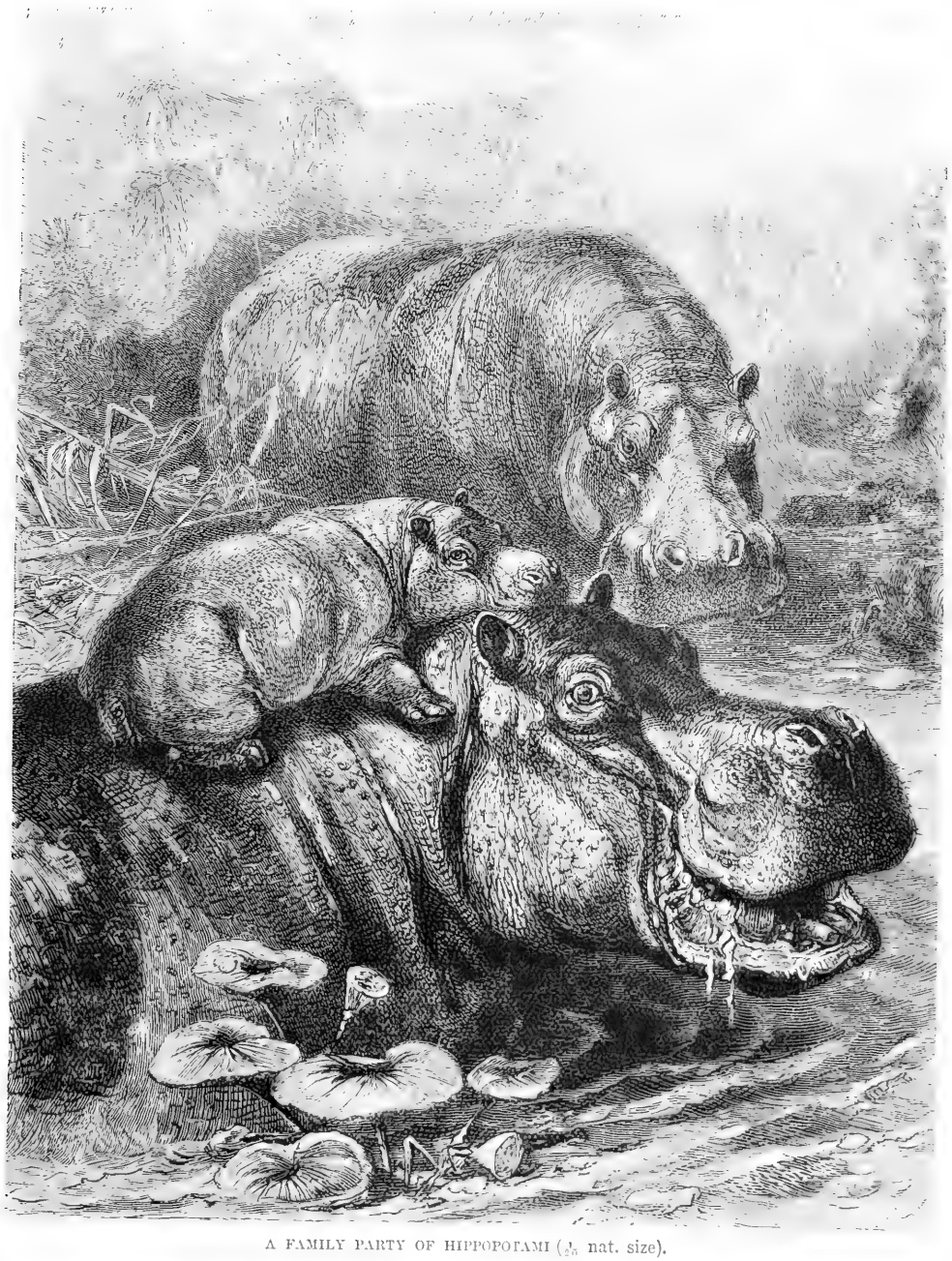
continually-growing incisor teeth; the complete ring of bone round the socket of the eye; and the hook-like flange at the hinder extremity of the lower jaw.

Common Hippopotamus.

The common hippopotamus (*Hippopotamus amphibius*) is by far the larger of the two living species, and next to the elephant would seem to be the bulkiest of all existing terrestrial Mammals. A male which lived for many years in the London Zoological Society's Gardens measured 12 feet from the tip of the snout to the root of the tail, the length of the latter appendage being 22 inches, and its total weight was about 4 tons. Sir Samuel Baker states that in an old male measured by himself the length was 14 feet 3 inches from the snout to the end of the tail, the latter being about 9 inches. And the same writer estimates the weight of the hide, when freshly removed, at about 5 cwts. The height at the shoulder is some 3 feet 8 inches. This species is further characterised by having two pairs of incisor teeth in each jaw, the middle lower pair being of far larger dimensions than the others. The general colour of the skin is a slaty copper-brown, tending more to blackish brown on the back and purplish brown beneath. There is, however, considerable sexual and individual variation in this respect; and the hue of the skin also varies according to whether the animal has recently emerged from the water, or whether it is thoroughly dry. Dr. Livingstone says that while the males are of a dark colour, the females are of a yellowish brown; and when hippopotami first leave the water the upper-parts appear brownish blue and the under-parts almost flesh-coloured, but when thoroughly dry the colour of the back is blackish brown or slaty. Sir John Kirk observed in East Africa nearly pure white and also spotted individuals, while in others only the feet were white. In certain cases, however, a more or less distinct reddish, purple, or yellow tinge has been noticed. The largest recorded pair of lower tusks of the hippopotamus have a total length of 31½ inches along the curve, and a basal circumference of just over 9 inches.

That the hippopotamus formerly inhabited Lower Egypt is indicated by the occurrence of its remains in the mud of the delta, while this is also confirmed by the frequency with which it is depicted in the ancient frescoes of that country. One of these frescoes preserved in the temple of Edfu shows that the ancient Egyptians were in the habit of harpooning these animals in much the same manner as is now practised on the upper reaches of the Nile. Teeth of the hippopotamus have been dug up at Kalabshi, a short distance above the first cataract; but at the present day the animal is not to be met with north of the neighbourhood of Dongola, in the Sudan, between the second and third cataracts. And even there, according to Sir S. Baker, it is comparatively rare, although a certain number take refuge in the wooded islands between Abou Hamed and Berber. Above Khartum, hippopotami are still to be found in large numbers. Generally, it may be stated that at the present day the hippopotamus inhabits most of the African rivers and lakes lying between the 17th parallel of north and the 25th of south latitude; that is to say, in the south it is found in the upper course of the Limpopo. Formerly, however, its distribution embraced the greater part of the Cape Colony. In East, South, and West Africa the hippopotamus comes much nearer to the coast than in the north, and in many districts it is to be found quite close to, or even in the sea itself. On the other hand, in Abyssinia these animals are found dwelling in Lake

Tzana-Dembea, at an elevation of over six thousand feet above the sea-level. The existing species is unknown in Madagascar; but from the reference to it in the



A FAMILY PARTY OF HIPPOPOTAMI ($\frac{1}{25}$ nat. size).

Bible, under the name of Behemoth, it is just possible that it may have inhabited Palestine within the historic period.

In the Pleistocene and upper portion of the Pliocene epoch a large hippopotamus

which appears specifically indistinguishable from the living kind was widely spread over Europe, extending from Italy in the south to England in the north. These fossil hippopotami were, however, of considerably larger dimensions than at least the average of the existing race. In England the range of the animal extended as far north as Yorkshire; and it is a remarkable circumstance that in several English localities remains of the hippopotamus are found lying side by side with those of the reindeer. It has been attempted to explain this association of such southern and northern types by assuming that in the Pleistocene period the summers were very hot and the winters very cold, and that during the summer the hippopotami wandered northwards into regions tenanted in winter by the reindeer. There are, however, difficulties in the way of accepting this explanation, not the least being the circumstance that the living African hippopotamus is not a migratory animal. We may, however, be pretty confident that wherever remains of hippopotami are found, there the rivers must have been free from ice throughout at least the greater part of the year.

Habits. The hippopotamus is more essentially an aquatic animal than any other Ungulate, the greater portion of its time being spent in the water, where its movements are far more rapid and natural than they are on land. As the carcase of a hippopotamus when freshly killed sinks rapidly to the bottom, the specific gravity of the animal when the lungs are inflated with air cannot be far, if at all, below that of water, and the animal is consequently enabled to stay without difficulty at the bottom of a river or lake, where it can run with ease and speed. Sir S. Baker states that, when undisturbed, the average duration of time during which a hippopotamus remains under water does not exceed five minutes; but in regions where these animals are much hunted the length of the immersion is often much greater, sometimes extending to as much as ten minutes. The same writer also mentions that when on the upper Nile in a steamer that was travelling about ten knots an hour, it was not till the engineer increased the pace by putting on full steam, they were able to overtake a hippopotamus swimming about a hundred yards in advance of the vessel. When a hippopotamus comes to the surface it generally spouts up a column of water by the violent blowing-out of air through the nostrils, accompanied by a loud snorting noise; but, as we shall again notice, these animals learn caution in these respects when much persecuted. A peculiarity of the hippopotamus is that when swimming in the water and about to dive, it gradually subsides by slowly sinking the hind-quarters and afterwards the rest of the body, instead of sinking down head-foremost. When on a high bank and suddenly frightened, it will not, however, hesitate to precipitate itself headlong into the water.

As the giraffe may be regarded as the most characteristic and striking animal in an African desert-landscape, so the hippopotamus forms the most distinctive living feature in a river-scene; and nothing can be more impressive than to come suddenly upon a herd of these gigantic animals on the margin of some unfrequented lake or river. Such a scene is graphically described by Mr. Selous, who writes that on one occasion his companion and himself, after making their way through a thick bush-jungle, suddenly emerged upon a river-bank. "Upon a spit of white sand which jutted into the pool from the opposite bank, stood, high and dry, a herd

of at least twenty hippopotami, their huge, bulky carcases looking, as they stood all huddled together, like so many black rocks." After mentioning that a water-buck standing on the further shore soon took alarm, Mr. Selous continues that the hippopotami, "though we were in full view and only about two hundred and fifty yards from them, did not seem to notice us, but stood quite motionless and apparently asleep, except that now and then one would move his enormous head slowly to the one side or the other. . . . At length they heard us talking, and commenced, one after the other, to walk into the river. When their bodies were half immersed they let themselves down with a splash, and either swam into deep water with just the tips of their heads out, or dived out of sight at once; I suppose there must have been a ledge beside which the water deepened suddenly. There were some quite small calves amongst them, and these little beasts all ran into the water with a splash, whilst the full-grown animals stepped in slowly and sedately." Similar testimony as to the ease with which hippopotami may be approached in undisturbed districts is afforded by Sir J. Willoughby in East Africa. When stealthily punting on a raft towards a small herd, this writer observes that the hippopotami, "did not seem to mind our approach in the least degree, but continued to enjoy themselves by puffing and snorting and blowing water in jets from their nostrils, and now and again sinking down, to reappear at the end of two or three minutes, and, with their heads half out of the water, to take a look round. When we were within thirty yards, they ceased their gambols to gaze with astonishment at what I suppose was the first attempt to navigate these waters."

On the White Nile Sir S. Baker states, that during the dry season he has seen a bend of the river so crowded with hippopotami, that it seemed impossible that his steamer would be able to make its way without coming into collision with some of the monsters. All, however, managed to steer clear of the path of the vessel, which passed through a perfect crowd of snorting and blowing heads.

Regarding the general habits and haunts of the hippopotamus, Dr. Livingstone states, that on the Chobi and other large rivers, the banks are marked by numerous furrows made by these animals in ascending during the night to graze on the herbage of the adjacent lands; and he adds that as they are guided back to these paths solely by scent, if a heavy rain comes on during their nocturnal excursions they are unable to find their way back to the river, and stand helpless on the land. The males generally remain in company with the females, although a few very aged individuals of the former sex may lead more or less solitary lives. "The still reaches," continues the same observer, "are their favourite haunts, as elsewhere the constant exertion necessary to keep themselves from being carried down the stream disturbs their nap. They remain by day in a drowsy yawning state, taking little notice of things at a distance. The males utter loud, snorting grunts, which may be heard a mile off. The young ones stand on the necks of their dams, and their small heads appear first above the surface as they rise to breathe. The dam, knowing the more urgent need of her calf, rises more frequently when it is in her care. In the rivers of Londa, where they are in danger of being shot, the hippopotami gain wit by experience; for while those in the Zambesi expose their heads, the others keep their noses among the water-plants, and breathe so quickly as to elude all observation."

On the banks of the White Nile, Sir S. Baker states that the favourite haunts of hippopotami are the dense masses of tall reeds fringing the river. There they pass a considerable portion of their time in marshy retreats among the canes; such dens would be impervious to human beings, and would not be observed unless from a vessel upon the river. The tangled mass of vegetation is pierced in numerous places by dark tunnels, which have been bored out by their bulky forms, and these gloomy routes form their channels of retreat, where they retire to sleep. Females, with their calves, are especially fond of these impervious bowers, where they are secure from all chances of molestation by man or beast.

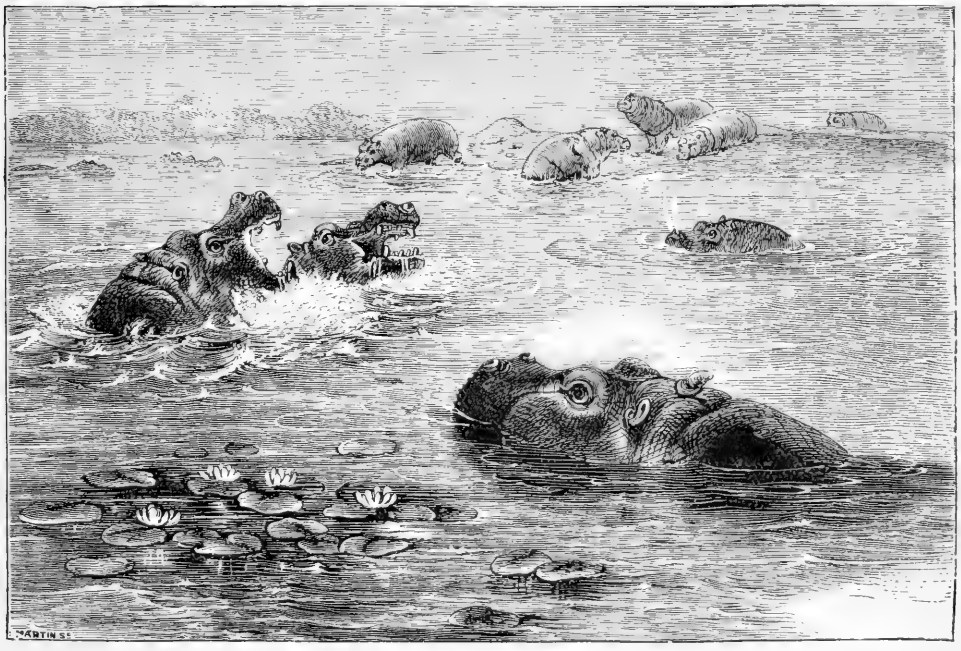
The hippopotamus is a purely herbivorous animal, and from its gigantic bulk consumes an enormous amount of food. The capacious stomach, which, when extended, measures some 11 feet in length, is indeed capable of containing between five and six bushels, which gives some idea of the vast quantity of nutriment the creature requires. In uncultivated districts, grass and various water-plants—more especially the lotus and papyrus—afford the chief food-supply; but where the land adjoining the rivers is under cultivation, the damage done to growing crops of rice, millet, maize, and sugar by hippopotami is incalculable. It is not only the amount they actually eat (although this is large enough), but the quantity damaged in their passage from one part of a field to another. Water-plants are dragged up by the roots from the beds of rivers and lakes, when not too deep, by the hippopotamus in its capacious mouth, and after being brought to the surface, are devoured at leisure. When starting for their nocturnal excursions in the fields, these animals seldom leave the river till about an hour after sunset, and do not return till dawn. On such expeditions they make a prodigious snorting and grunting, which may be heard for long distances.

There is usually but a single offspring produced at a birth, and Sir S. Baker says that he has never seen a female hippopotamus accompanied by more than two calves. The period of gestation is a little short of eight months, and it would seem that the young may be brought forth at any season of the year. The mother, as we have already noticed, is sedulous in her attention to her offspring, but the male is apt to be evilly disposed towards it. Males, according to Sir S. Baker's account, are constantly fighting among themselves at night, and apparently irrespective of any particular pairing-season; and it is also stated by the same observer that a wounded animal may be furiously attacked by a comrade.

The full age attained by the hippopotamus in its wild state has not been ascertained, but, since a calf brought to the London Zoological Society's Gardens in 1850 survived till 1878, the span of life must be considerable.

In disposition the hippopotamus is generally described as comparatively timid, but when a boat passes unexpectedly into the middle of a sleeping herd, or comes close to a solitary individual at night, the results are apt to be serious. Sir S. Baker says that, when travelling by night in an ordinary boat on the Nile, "there is no possibility of escape should a hippopotamus take into his head that your vessel is an enemy. The creature's snort may be heard at a few yards' distance in the darkness, and the next moment you may be overturned by an attack from beneath, where the enemy was unseen." Dr. Livingstone relates how that on the Chobi a solitary male issued from its lair and charged some of his company with

considerable speed, and it was reported to him that another had completely smashed a canoe with a single blow from its hind foot. On another occasion a female hippopotamus, whose young had been speared the previous day, rose suddenly beneath the canoe containing Livingstone and seven natives, and with her head lifted one half of it completely out of the water, so as nearly to overturn it. On the White Nile one of these animals boldly charged one of Sir S. Baker's steamers, and, not content with breaking several floats from one of the paddle-wheels, actually knocked two large holes with its tusks in the bottom of the vessel. The same writer also relates that a hippopotamus once struck the bottom of a "dug-out" canoe measuring twenty-seven feet in length with such force as to lift it partially out of the water. The most extraordinary incident of wanton maliciousness on



HIPPOPOTAMI AT HOME.

the part of these animals is, however, one also recorded by Sir S. Baker. His natives were swimming a herd of about twenty cattle across the Nile, when they were suddenly attacked by a party of hippopotami, some of which seized with open jaws several of the cows and dragged them beneath the water, never to reappear.

Hunting. As already mentioned, the ancient Egyptians were in the habit of harpooning the hippopotamus, and this custom is still kept up by the Sudanis on the upper Nile. The usual plan when a party of these animals has been observed in the river, is for a couple of hunters, each armed with a harpoon to which a line is attached, to enter the river some distance above, and swim cautiously down on the herd. When within striking distance, both men hurl their weapons at the same time. To each line is attached a wooden float, which marks the position of the animal while below the surface, and the chase is taken up by other hunters on the bank armed with harpoons and lances. By an ingenious

arrangement, the float is at length captured by a rope and the animal dragged to shore, where it is despatched with lances. This, however, Sir S. Baker states, is frequently not accomplished without the death of one or more of the intrepid hunters. In Central Africa, on the other hand, the hippopotamus is harpooned from canoes. In other parts the favourite method is to suspend a weighted spear, frequently tipped with poison, over a branch of a tree near the tracks of the hippopotamus, and to make fast the end of the line, to which it is attached to stakes on either side of the path. When the animal comes along, it strikes against the line, the stakes are loosened, and the heavy spear comes down with a thud on its head or back. Yet another plan is to construct pitfalls in the paths frequented by these animals, and to cover them over carefully on the top with boughs, reeds, or grass.

The most cruel method is, however, one sometimes employed by the Kaffirs of South-Eastern Africa, who, as Mr. Selous relates, are in the habit of starving the unfortunate brutes. They select a pool in a river where the bottom is sandy, and consequently where there is no vegetation; and for choice they prefer a pool with a high bank on one side. Having driven or watched a party of hippopotami into such a pool, the Kaffirs form a hedge round the open sides, and thus render egress impossible. Mr. Selous states that on one occasion he came across such a pool, where, so far as he could ascertain, the animals had been enclosed for about three weeks. When his party reached the scene of operations there were still ten living hippopotami in the pool. "Eight of these seemed to be standing on the bank in the middle of the water, as more than half their bodies were exposed; the poor brutes were all huddled up in a mass, each with his upraised head resting on another's body. Two more were swimming about, each with a very heavily-shafted assegai sticking in his back; these assegais are plunged into them at night when the starving beasts come near the fences seeking for a means of exit from their horrible prison."

Europeans are in the habit of shooting hippopotami with rifles, but most who have tried this sport agree that, when the novelty has worn off, it is not of a very exciting nature. Although when first killed the carcase of a hippopotamus sinks to the bottom immediately after death, it will rise within twenty-four hours, owing to the generation of gases in the stomach, if the depth of water does not exceed some twenty-five feet.

Products. Formerly hippopotamus ivory was valued for the manufacture of artificial teeth, and in the early part of this century it fetched as much as twenty-five shillings per lb. Now, however, the animal is hunted solely for its hide and fat, or for the sake of its flesh as food. The hide is used for whips, and, according to Sir S. Baker, also for facing revolving wheels employed in polishing steel. A good hippopotamus will yield about 200 lbs. of pure fat; and the writer last named states that the flesh of the hippopotamus is always palatable, that of the young calf being delicious; the feet of the latter making an excellent stew, and its skin soup which has been compared to turtle.

In Captivity. Hippopotami thrive well in captivity, and breed not unfrequently. The first specimen exhibited in the London Zoological Society's Gardens was captured on the upper Nile in 1849, and brought to England in

the following year, where, as already mentioned, it lived till 1878. This was a male, and although a consort was obtained for it in 1853, no young were produced till 1871. The calf born in that year did not, however, long survive, and the same untimely fate also befell a second calf produced in the spring of the following year. A third calf was born in the autumn of 1872, and is still living (1894).

Pigmy Hippopotamus. The Liberian or pigmy hippopotamus (*H. liberiensis*) from Western Africa is a much smaller animal, not exceeding a pig in dimensions, and weighing only about 400 lbs. This species differs structurally from the common one in having only a single pair of incisor teeth in the lower jaw, although a small representative of the second pair may sometimes occur on one side. The colour of the back is slaty black, while that of the under-parts is dirty greyish white, and the sides greenish slaty grey. The height at the shoulder is about 2 feet 6 inches, and the total length 6 feet, of which 7 inches are occupied by the tail.

Habits. This diminutive species appears to be confined to Upper Guinea, and according to Herr Büttikofer is found only in swamps and damp forests, and not in rivers. Its habits are said, indeed, to be more like those of wild swine than those of its gigantic cousin, and, instead of traversing well-beaten paths, it wanders great distances in the woods. The author quoted is uncertain whether the Liberian hippopotamus is nocturnal or diurnal in its habits, although he is inclined to believe that it is the latter. It is, however, certain that it lives either solitary or in pairs, and that it never associates in troops like the larger species.

Extinct Hippopotami. Among extinct species of the genus, the Maltese hippopotamus (*H. minutus*), of which the remains are found in such enormous quantities in the caverns of Malta and Sicily, appears to have been no larger than the Liberian species, though it resembled the ordinary living African one in the number of its lower incisor teeth. Intermediate in size between the Maltese and the common hippopotamus was Pentland's hippopotamus (*H. pentlandi*), found in the same deposits as the former. The vast quantities in which the remains of these two extinct species are found in the Sicilian caves presents a puzzle, since hippopotami are not the sort of animals which one would expect to frequent such habitations. Some years ago many shiploads of teeth and bones of these species were imported into England from Palermo for the manufacture of charcoal.

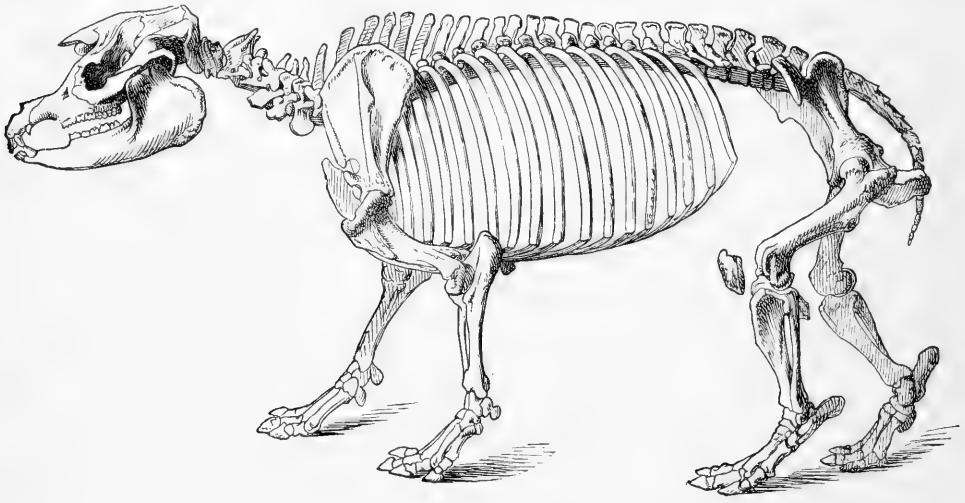
Although hippopotami are now quite unknown in India, during the Pleistocene and Pliocene epochs they were abundant in that country. In the Pleistocene of the Narbada Valley in Central India remains of two species of the genus are met with; one of these (*H. palæindicus*) being characterised by the presence on each side of the lower jaw of a small incisor tooth between the two larger ones, corresponding to those of the common African hippopotamus; while in the second Narbada species (*H. namadicus*) both upper and lower jaws were provided with three nearly equal-sized pairs of incisor teeth. The same condition also obtains in the Siwalik hippopotamus (*H. sivalensis*) from the Pliocene rocks at the foot of the Himalaya, and likewise in the Pliocene Burmese hippopotamus (*H. iravadicus*) and the Algerian hippopotamus (*H. bonariensis*), which was likewise of Pliocene age. An extinct hippopotamus (*H. lemerlei*) has also been discovered in the superficial deposits of Madagascar.

CHAPTER XXVI.

UNGULATES,—*continued.*

TAPIRS, RHINOCEROSES, AND HORSES.

WITH the three groups of animals known as tapirs, rhinoceroses, and horses, we come to an assemblage of Ungulates differing in many important respects from all those described in the preceding chapters, and collectively constituting a distinct primary division of the order to which they belong. The most obvious external



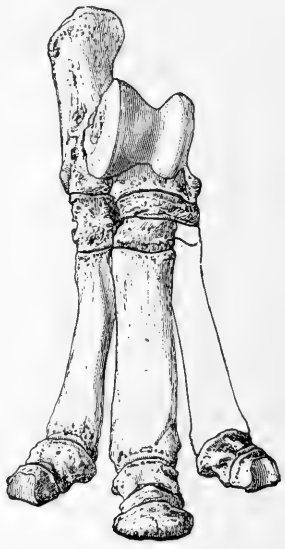
SKELETON OF MALAYAN TAPIR.

characteristics of this assemblage of animals are displayed by their feet, in which, as we have already had occasion to mention (p. 153), the toe corresponding to the third or middle finger of the human hand, or to the middle toe of the human foot, is always larger than either of the others, and is symmetrical in itself. This peculiarity of foot-structure is exhibited in the accompanying figure, and likewise in the smaller figures on p. 455; and how essentially different it is from the type of foot obtaining in the even-toed Ungulates will be apparent by contrasting these figures with the illustration of the foot of the pig given on p. 422. In all the Even-toed Ungulates, we may once again remind our readers, instead of the third toe being symmetrical in itself and larger than either of the others, it is symmetrical to a line drawn between itself and the fourth toe, and is equal in size to the latter, with which it forms a pair.

Although in the members of the present group the number of toes in the foot is frequently three, it may be increased to four or diminished to one; yet in all

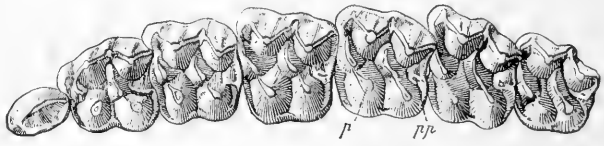
these variations the symmetry of the third digit is preserved. And it is on account of the prominence of this same digit that the group has received the designation of the Odd-toed, or Perissodactyle Ungulates.

Another distinctive feature of this group is to be found in the conformation of the astragalus of the ankle-joint of the hind-foot. This bone, which forms the upper right-hand corner of the accompanying figure of the hind-foot of a rhinoceros, is characterised by its deeply-grooved pulley-like superior surface, while inferiorly it is abruptly truncated; and, unlike that of the Even-toed group, it has not a facet for articulation with the fibula, or smaller bone of the leg. The astragalus of an Even-toed Ungulate is, on the other hand, a more elongated bone, with its lower surface highly convex, and divided into two distinct moieties. A third very important characteristic of the limbs of the Odd-toed Ungulates is that the femur, or bone of the upper segment of the hind-leg, is furnished with a projecting crest on the upper part of its hinder surface known as the third trochanter; this trochanter (of which the position is clearly shown in the left hind-limb of the figure of the skeleton of the tapir) being quite unknown among the Even-toed Ungulates.



BONES OF THE RIGHT HIND-FOOT OF AN EXTINCT RHINOCEROS. (From Osborn.)

The foregoing characteristics of the feet are alone sufficient to distinguish the Odd-toed Ungulates from the even-toed group, but there are also certain other features—especially some connected with the teeth—which it is advisable to notice. As regards the cheek-teeth, it may be observed that in the upper jaw the premolars (as shown in the accompanying figure) are generally as complex as the molars, whereas in most members of the Even-toed group they are simpler. Then, again, all the upper cheek-teeth, with the exception of the first, in most of the earlier and more primitive representatives of the group are characterised by carrying six columns or cusps on their crowns, of which the two innermost pairs tend to unite more or less completely, and thus form a pair of oblique transverse ridges, extending across the crown to the two outer columns; the two latter also uniting to form a longitudinal outer wall to the tooth. From this primitive type of tooth all the more specialised developments may be derived, and, as we shall have occasion to notice later on, while the earlier forms have low-crowned molar teeth, like those represented in the figure, some of the later types have the crowns greatly elongated in the vertical direction. In this respect, therefore, the Odd-toed Ungulates have developed in a manner exactly paralleled among the Even-toed group, a similar parallelism being also noticeable in respect to the reduction of the number of toes on the feet. Moreover, as we find in the Even-toed Ungulates



THE LEFT UPPER CHEEK-TEETH OF THE ANCHITHERE. (From Osborn.)

an increased length in the metacarpal and metatarsal bones of those forms in which but two functional bones remain, so in the present group there is a similar elongation of the single metacarpal and metatarsal (cannon) bones in its one-toed representatives, namely, the horses. It is only of late years that the great importance played by parallelism in the development of allied groups of animals has been fully recognised, and fresh instances of it are being constantly discovered. In no group are there better examples of this phenomenon than among the Ungulates, where it is displayed among several groups, and affects totally different parts of the skeleton.

The lower cheek-teeth of the Odd-toed Ungulates very generally differ from those of the other main group in that the last of the series resembles those in advance of it in having two lobes, this feature being distinctive of the whole of the existing members of the group. On the other hand, in all the living representatives of the even-toed group, with the single exception of one small antelope (*Neotragus*, p. 309), the corresponding tooth has three distinct lobes. Generally, the lower cheek-teeth of the present group carry either two transverse ridges or a pair of crescents, one in front of the other, on their crowns. It may be added that all the Odd-toed Ungulates have simple stomachs, and that in all cases the liver is not provided with a gall-bladder.

The whole of the living Odd-toed Ungulates may be divided into three well-marked family groups, which are commonly designated as tapirs, rhinoceroses, and horses (the latter term including zebras, asses, etc.); and according to the classification adopted in this work, each of these three families is now represented only by a single genus. With the exception of the tapirs, which are common to the Malayan region and Central and South America, all the existing Odd-toed Ungulates are Old World animals. Moreover, all the three groups are represented by a comparatively small number of species, while, with the exception of the horses, these species are far inferior in the number of individuals by which they are represented to the majority of the Even-toed Ungulates. All these circumstances point to the conclusion that, as a whole, the Odd-toed Ungulates are a waning group; and this conclusion is fully supported by the discoveries of palæontology. Thus, in the first place, both rhinoceroses and horses were abundantly represented during former epochs in the New World; while, in the second place, the rocks of both hemispheres have yielded fossil remains of an enormous number of extinct generic, and even family, types of Odd-toed Ungulates, several of which serve to connect very closely together the three living groups. What may have been the reason of this gradual waning of the Odd-toed Ungulates, and the enormous development of the Even-toed group during the later geological epochs, it is not easy to divine. Perhaps, however, it may be that the former group is one of a lower and less adaptive nature than the latter. The horses are, however, an exception to the other members of the present group, both as regards the number of species and individuals (irrespective of those bred by man), and belong to a specialised branch which has been raised to a platform of evolution as high as that occupied by the Ox family in the other group. Even here, however, it is hard to understand why horses (until reintroduced by the Spaniards) became extinct throughout the New World, unless indeed Mr. W. H. Hudson's suggestion that they were exterminated by pumas should prove to be well founded.

The Tapirs.

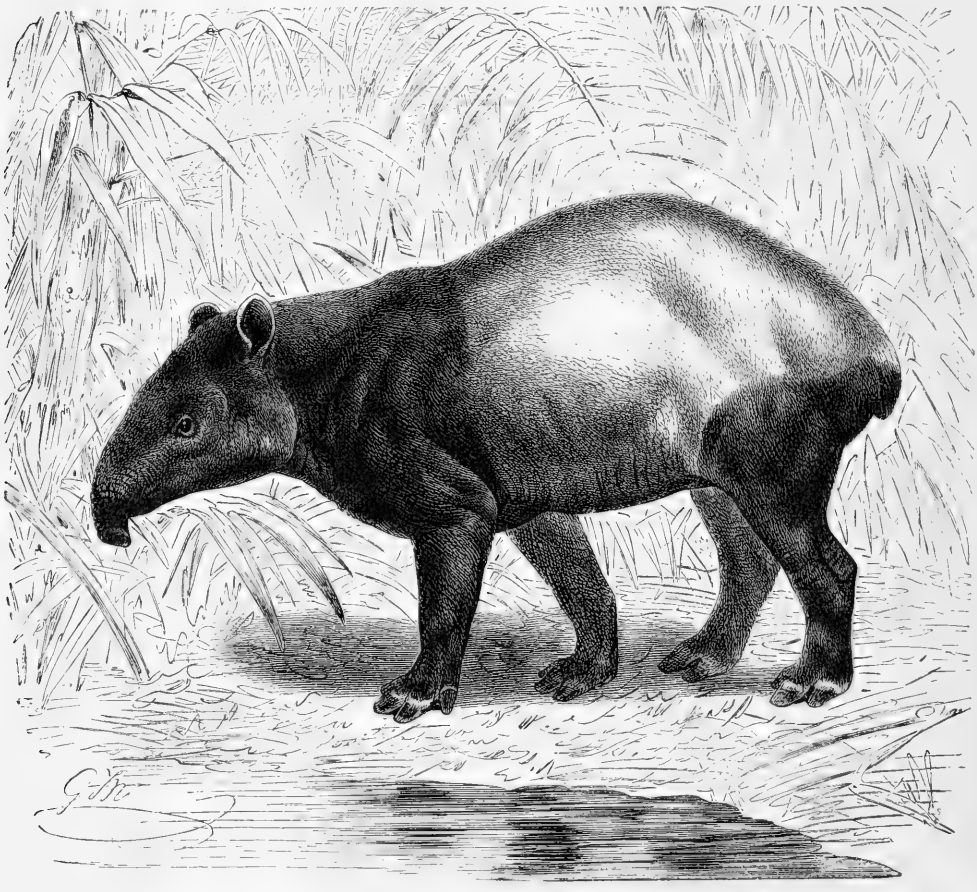
Family *Tapiridæ.*

The tapirs are the least specialised of all the existing Odd-toed Ungulates, and their peculiarly antediluvian appearance would indeed suggest this even to the unscientific observer. Their generalised character is indicated by the circumstance that they differ from all other living members of the same great group by having four toes to their fore-feet, although their hind-feet resemble those of the rhinoceroses in being tridactyle. In the fore-feet the three main toes correspond to the three middle fingers of the human hand, while the small external one represents the fifth, or little finger. The tapirs are further characterised by the production of the extremity of the muzzle into a short cylindrical proboscis or trunk, at the extremity of which are situated the nostrils. The general form of the body is heavy and ungainly, the limbs being relatively short and stout, and the tail scarcely more than a rudiment. The eyes are small in proportion to the size of the head, and the erect and oval ears of moderate size. The thick skin is smooth and covered with a rather scanty coat of short hair, which is usually of uniform colour.

The skull, as seen in the figure of the skeleton on p. 454, is rather short, narrow, and high, its most distinctive features being the enormous size of the aperture of the nose, and the absence of any bony bar dividing the socket of the eye from the great channel on the side of the brain-case. The teeth are forty-two in number, or two less than the full typical number, the missing ones being the first premolar on each side of the lower jaw. The short-crowned cheek-teeth are separated from those in the front of the jaws by a long gap, and the tusks, or canines, are small, those of the upper jaw being inferior in dimensions to the outermost pair of incisors. The upper cheek-teeth have two transverse ridges and an outer longitudinal wall, while those of the lower jaw carry a pair of transverse ridges alone. In the limbs all the bones are fully developed and quite distinct from one another. It may be added that the toes are encased in long and rather oval hoofs, while inferiorly the foot is furnished with a large callous pad, which takes a share in supporting the weight of the body. Except when the soil is soft and yielding, the small outermost toe of the fore-foot scarcely touches the ground.

Distribution. The existing tapirs, all of which may be included in the one genus *Tapirus*, have a most remarkable geographical distribution, a solitary species being found in the Malayan region, while the whole of the other four are restricted to Central and South America. Still more remarkable is the circumstance that, instead of all the American species being closely allied, two of them are nearly related to the Malayan tapir, while the other two form a totally distinct group. A flood of light on this remarkable instance of what is known as discontinuous distribution is, however, thrown by palæontology, remains of extinct tapirs having been discovered in the middle and upper Tertiary rocks of Europe (including those of England) and China, while nearly-allied or identical forms occur in those of the United States. Such remains are also found in the cavern-deposits of Brazil, which belong to the later Pleistocene epoch. Since these extinct forms

belong to the existing genus, tapirs may be regarded as among the oldest of living Mammals. It was considered by Mr. Wallace that the Old World was the original home of the group, from whence they migrated to North America; but subsequent discoveries have rendered this doubtful. Probably, however, they are but comparatively recent immigrants into Central and South America. And it is interesting to notice, as Mr. Wallace observes, that while in the Old World, where they were once so abundant, they have dwindled down to a single species, existing in small numbers in the Malay Peninsula, Sumatra, and Borneo only, in the western



THE MALAYAN TAPIR ($\frac{1}{15}$ nat. size).

continent they occupy a much larger area, and are represented by several distinct species. With regard to the probable ancestors of the tapirs, we shall have some remarks to make at the conclusion of this chapter.

Save for the circumstance that the Malayan species differs from all the rest in coloration, the various kinds of tapirs are remarkably alike, both in respect of bodily form and habits. Whereas, however, four of the species are found at or near the sea-level, the fifth inhabits comparatively high elevations in the Cordilleras.

Habits. Speaking of tapirs in general, Sir W. H. Flower remarks that "they are solitary, nocturnal, shy, and inoffensive, chiefly frequenting

the depths of shady forests and the neighbourhood of water, to which they frequently resort for the purpose of bathing, and in which they often take refuge when pursued. They feed on various vegetable substances, as shoots of trees and bushes, buds and leaves."

Malayan Tapir. The Malayan tapir (*T. indicus*) is the largest of the whole group, and differs from all the others in its parti-coloured skin. In height this animal stands from 3 to $3\frac{1}{2}$ feet at the withers, and about 4 inches more at the rump, its length along the curves from the tip of the snout to the root of the tail being about 8 feet. In the adult the colour of the head and front of the body, as well as the limbs, is dark brown or black, while the body from behind the shoulders to the rump and the upper part of the thighs is greyish white, as are also the ears. On the other hand, the newly-born young are brownish or velvety black, marked with spots and longitudinal streaks of brownish yellow on the sides, and of white beneath; the change from the young to the adult coloration taking place, according to Mr. Blanford, between four and six months after birth.

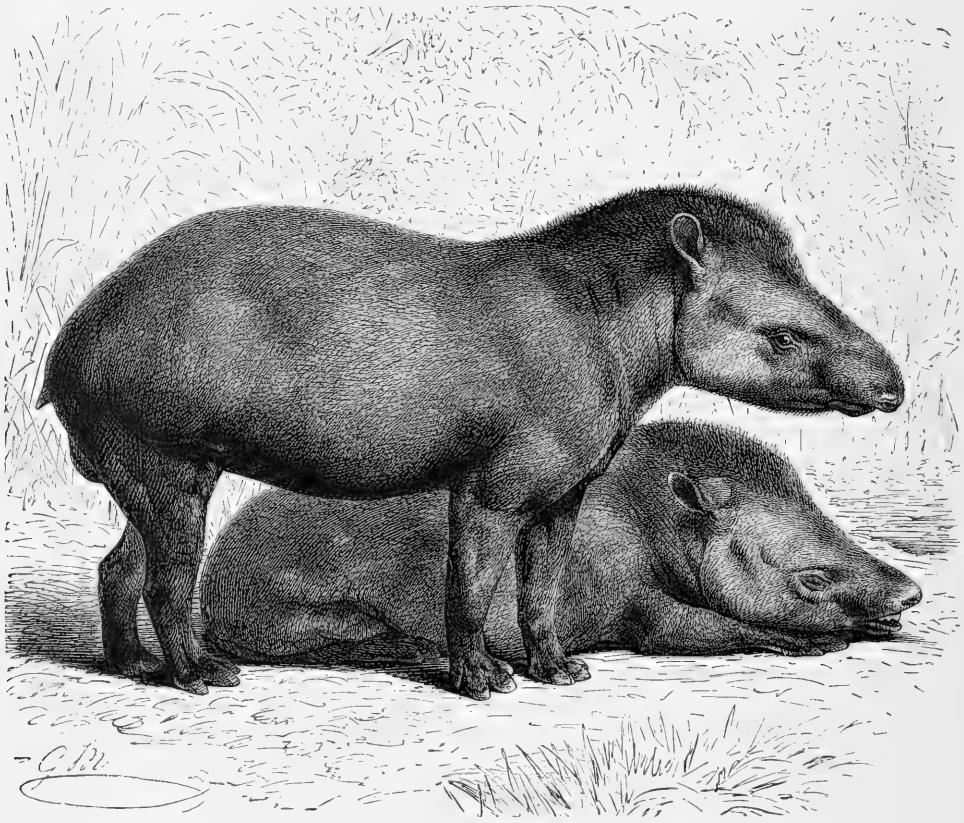
The Malayan tapir is found in the peninsula from which it takes its name, extending northwards to Tenasserim, and it also occurs in the island of Sumatra, and perhaps in Borneo. Although one of its skulls had been sent to the Asiatic Society of Bengal in Calcutta as far back as the year 1806, it was not till Diard in 1817 sent to Cuvier a portrait and description of a specimen then living in the viceroy's menagerie in Barrakpur, near Calcutta, that it was recognised in Europe as a distinct species. Apart from a notice by Wahlfeldt in 1772, Sir Stamford Raffles had, however, knowledge of the creature's existence in 1805, and in 1816 Major Farquhar sent a description of the animal to the Asiatic Society of Bengal.

Owing to its retiring nature, the Malayan tapir is but seldom seen in its native haunts, and our information as to its habits is consequently meagre in the extreme. Indeed, nothing is known as to its breeding-habits, although it seems to be ascertained that but one young is produced at a birth. Mr. Mason writes that, "though seen so rarely, the tapir is by no means uncommon in the interior of the Tavoy and Mergui provinces. I have frequently come upon its recent footmarks, but it avoids the inhabited parts of the country." When taking to the water, it is reported to plunge in and walk along the bottom, instead of swimming. In spite of its shy and retiring habits, this tapir, if captured at a sufficiently early period, can be readily tamed, and is said to exhibit considerable attachment to its master.

American Tapirs. Of the New World tapirs the best known species is the common South American tapir (*T. americanus*), originally described by Linnæus as a terrestrial species of hippopotamus. In common with the other American kinds, the adult is of a uniform dark brown or blackish colour, although the young are striped and spotted after the manner of the Asiatic species. The snout is shorter than in the latter, the hinder part of the head more elevated, and the crown of the head and neck furnished with a short, stiff, upright mane. The margins of the ears are white. This species inhabits the forest-districts of Brazil, Paraguay, and the northern part of Argentina. The second member of this group is Roulin's tapir (*T. roulini*), which is a mountain species inhabiting the Cordilleras of Ecuador and Colombia at an elevation of from seven thousand to eight thousand feet above the sea, and locally known as the pinchaque. It has a less vaulted skull and a rounder

neck, without distinct crest, than the lowland species, from which it is further distinguished by the presence of a long white spot on the chin.

The two remaining species are Baird's tapir (*T. bairdi*), ranging from Mexico to Panama, and Dow's tapir (*T. dowi*), restricted to Guatemala, Nicaragua, and Costa Rica, which constitute a second group of the genus distinguished by the characters of the skull. In all the three species of the first group, as seen in the figure of the skeleton given on p. 454, the nasal cavity is perfectly open in advance of the roofing bones of the skull; but in those of the second group this cavity is



THE AMERICAN TAPIR ($\frac{1}{16}$ nat. size).

divided by a vertical partition in the middle line, similar to one shown later on in the figure of the skull of an extinct rhinoceros.

Habits. The following notes on the habits of the American tapirs refer mainly or exclusively to the common species. These tapirs confine themselves exclusively to the thickest parts of the forests, carefully avoiding all open spaces, and forming regular pathways along which they travel in search of food and water. In the forest itself it is generally difficult to come across them, but Humboldt and others state that, when travelling on the rivers by boat, tapirs may be often seen in the early morning, when they come to the bank for the purpose of drinking. Although mainly nocturnal, it is stated that in the densest and darkest portions of the forest tapirs may be encountered abroad during the

daytime. They are fond of gamboling in the water and rolling in soft mud, their hides being often thickly plastered with the latter, probably as a protection against the bites of insects. Indeed, in many respects their mode of life is very similar to that of swine, although in their more solitary habits they present a closer resemblance to their cousins the rhinoceroses. Thus the males, except during the pairing-season, are said to be completely solitary, and even family parties are but rarely met with; and, except when several have been temporarily collected by the attraction of unusually good pasture, it is but very seldom that more than three individuals are seen in company. Tapirs commence to feed in the evening, and probably continue throughout the greater part of the night.

These animals are slow and deliberate in their movements, usually walking with their snouts close to the ground, and by the aid of scent or sound detecting the presence of foes with extreme acuteness. When frightened, however, they rush blindly forwards, crashing through bushes or splashing through water in precipitate flight. The American tapir is an excellent swimmer, crossing the largest rivers with facility, and even diving beneath the surface of the water, although with what object is not ascertained. Not improbably it may also walk along the beds of shallow rivers and lakes, as was observed to be the habit of a specimen of the Malayan species kept in captivity at Barrakpur.

The chief sound uttered by the American tapir is a peculiar shrill whistle, which, according to Azara, has but little volume in comparison with the size of the animal by which it is emitted. This whistle is uttered at all seasons, and is not, as has been supposed, restricted to the pairing-season; the Malayan species is reported to give vent to a very similar sound. When suddenly disturbed, the American tapir utters a loud snort.

Although in general perfectly harmless animals, fleeing precipitately before the smallest dog, tapirs will sometimes attack their enemies fiercely, this being more especially the case with females that have been deprived of their young. In such instances they rush violently at their foes—human or otherwise—and after knocking them down will trample upon and bite them after the manner of wild swine.

In Brazil, the food of the tapir is largely composed of palm-leaves in districts remote from cultivation, but at certain seasons of the year these animals subsist almost exclusively on fallen fruits, while in other districts swamp-grasses and water-plants form their chief nutriment. In the neighbourhood of plantations they frequently do much harm to the crops of sugar-cane, melons, etc., and they are especially dreaded by the proprietors of cacao-plantations for the amount of damage they inflict on the young plants. Salt seems especially grateful to their palate, and in order to obtain it they will eat the saline earth found in many parts of South America. In captivity they are fond of any sweet substances, and it is also said that in this condition they frequently become almost as omnivorous as swine. The American species can be as easily tamed as their Asiatic cousin, and tame individuals may sometimes be seen at large in the streets of some of the South American towns.

Hunting. Although on account of their affording no trophies in the shape of horns, antlers, or tusks, tapirs offer no attraction to European

sportsmen, yet they are much sought after by the native South-American hunters for the sake of their flesh and hide. The flesh is said to be juicy and well-flavoured, and both in appearance and taste resembles beef. The skin, which is of great thickness and strength, is cut into long thongs, which, after being rounded and treated with fat, are used for reins and bridles. It is, however, unsuited for shoe-leather, as it becomes very hard and unyielding when dry, and very soft and spongy when wetted. The hairs, hoofs, and certain other parts are used by the natives as medicine; the hoofs being sometimes hung round the neck as charms, and in other cases ground to powder and taken internally.

In South America tapirs are generally hunted with the aid of dogs, which chase the animals through the forest until they enter the water. Here they are attacked by the hunters, who have lain concealed among the reeds on the river bank, and by them they are pursued as they dive and swim in the water. When the area of water is not too large, the chase is frequently of no great duration, and the animal is before long despatched either with a club or a hunting-knife. Sometimes, however, the hunt is more protracted, the tapir leaving the water and breaking away from the dogs among the dense reeds or bushes, until again brought to bay in another pool or river. The traveller Schomburgk gives a graphic account of a tapir hunt he once witnessed when in South America. As his vessel rounded a headland on the river, a female tapir with her young came into view standing on a sandbank. Scarcely, however, had his Indians time to utter the word "Maipuri" (the native name of the common species), than the two animals caught sight of the party, and dashed into the thick cover on the bank. This cover was in the form of giant reeds and grass, with sharp-cutting edges, some seven feet in height, which offered a formidable obstacle to the progress of Europeans. The Indians, however, wriggled their way between the stems like snakes; and soon two shots in quick succession, followed by a shout of triumph, told that they had come up with their quarry. When Schomburgk reached the scene, he passed the female tapir lying dead with a bullet through the lungs. The dogs then took up the trail of the young one, which was concealed among the reeds. As soon as the creature perceived that it was discovered by the dogs, it uttered the peculiar whistling cry, mentioned above, by which the hunters were guided to its place of concealment. Eventually the young tapir, which was about the size of an ordinary full-grown pig, broke cover, and after an exciting although short chase was despatched.

In some parts the South American Indians track the tapir to its lair, and shoot it as it lies. In Paraguay, when the hunters capture a young tapir of too large a size to be carried on a horse in front of the rider, they bore a hole in one side of the snout through which they pass a thong, and the animal will then follow readily enough when led.

Foes.

Next to man, the worst foes of the tapir are the larger cats; the jaguar preying largely on the American species (as depicted in the coloured Plate in the first volume), and the tiger attacking its Malayan cousin. It is said that when an American tapir is attacked by a jaguar, it immediately rushes into the thickest cover in the hope of dislodging its assailant, which from the thickness of the animal's hide is unable to obtain a firm hold on its back.

It is further reported that the tapir is not unfrequently successful; and, in any case, many of these animals are killed with the marks of jaguar's claws on their backs.

Succession of Teeth. Before leaving these animals, it may be mentioned that the whole of the four premolar teeth on each side of the upper jaw are preceded by milk-teeth, whereas in the pig and other Even-toed Ungulates the first of these teeth never has a deciduous predecessor, as, indeed, is the case with other groups of Mammals. Some rhinoceroses, however, resemble the tapirs in having the first premolar preceded by a milk-tooth, although this seems to be merely an individual, and not a specific peculiarity.

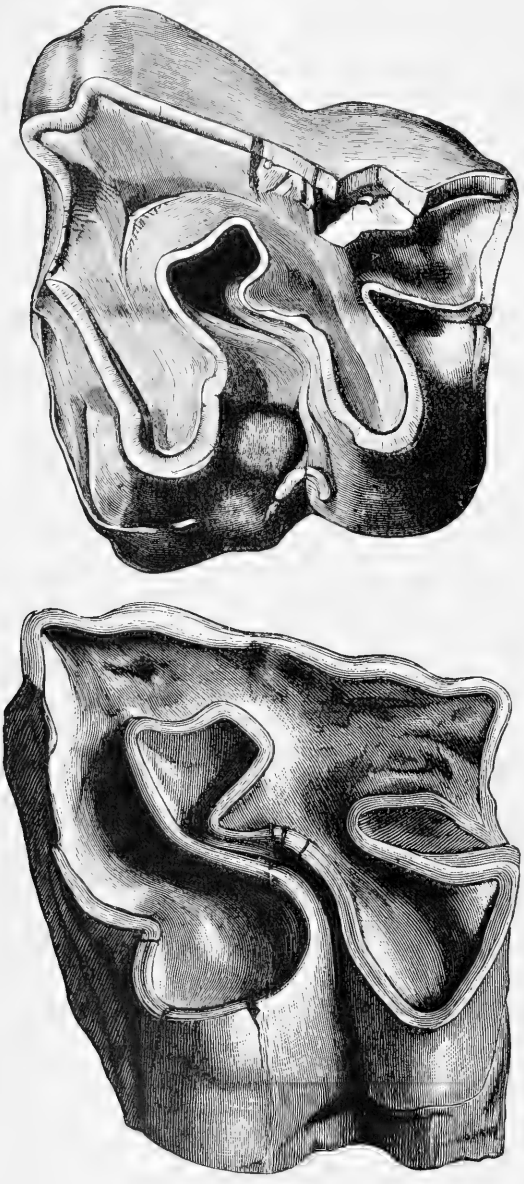
The Rhinoceroses.

Family *Rhinocerotidæ.*

Although inferior in length of body, and probably also in weight, to the hippopotamus, the larger species of rhinoceros exceed it in height, and, therefore, vie with it in claiming the position of being the Mammals next in point of size to the elephants. Unlike the tapirs, the various species of rhinoceros, all of which are now confined to the Old World, differ very markedly from one another in structure—so much so, indeed, that by many writers they are divided into several genera; and there is also considerable disparity in point of size. In spite, however, of these minor differences, all these animals are so much alike in general appearance, that it seems preferable to include the whole of them in the single genus *Rhinoceros*. All the existing rhinoceroses differ from tapirs in having but three toes on both fore and hind-feet, but since there are some extinct species with four toes to the front limbs, this point of distinction cannot be regarded as a very important one. The presence of one or two horns in the middle line of the front of the head might at first sight be regarded as a more valuable diagnostic character, but since these appendages are always or frequently absent in the female of one of the living Indian rhinoceroses, and are invariably wanting in certain extinct kinds, it will be obvious that other features must be sought that will distinguish these animals from the tapirs.

Teeth. Such characteristics are to be found in the cheek-teeth, of which two from the upper jaws of certain extinct species are represented in the figures on next page. In the molar teeth of the upper jaw the two outer columns have completely coalesced so as to form a continuous external wall to the crown; this wall being sinuous, and in some cases (as in the upper figure) forming a prominent buttress at the front outer angle of the crown. From this outer wall proceed two continuous oblique transverse ridges, separated from one another by a deep valley, interrupted by projecting processes from one or both ridges, and sometimes also from the outer wall. This middle valley is usually quite free from cement; and its form, as likewise the relative height of the whole crown, varies considerably in the different species. Instead of having the simple transverse ridges found in those of the tapirs, the lower cheek-teeth of the rhinoceroses have a pair of crescents, placed one in front of the other. On each

side of both the upper and lower jaw there are seven cheek-teeth; but the last molar in the upper jaw differs from the rest in having its hinder ridge more or less aborted, so that the form of the crown is generally triangular.

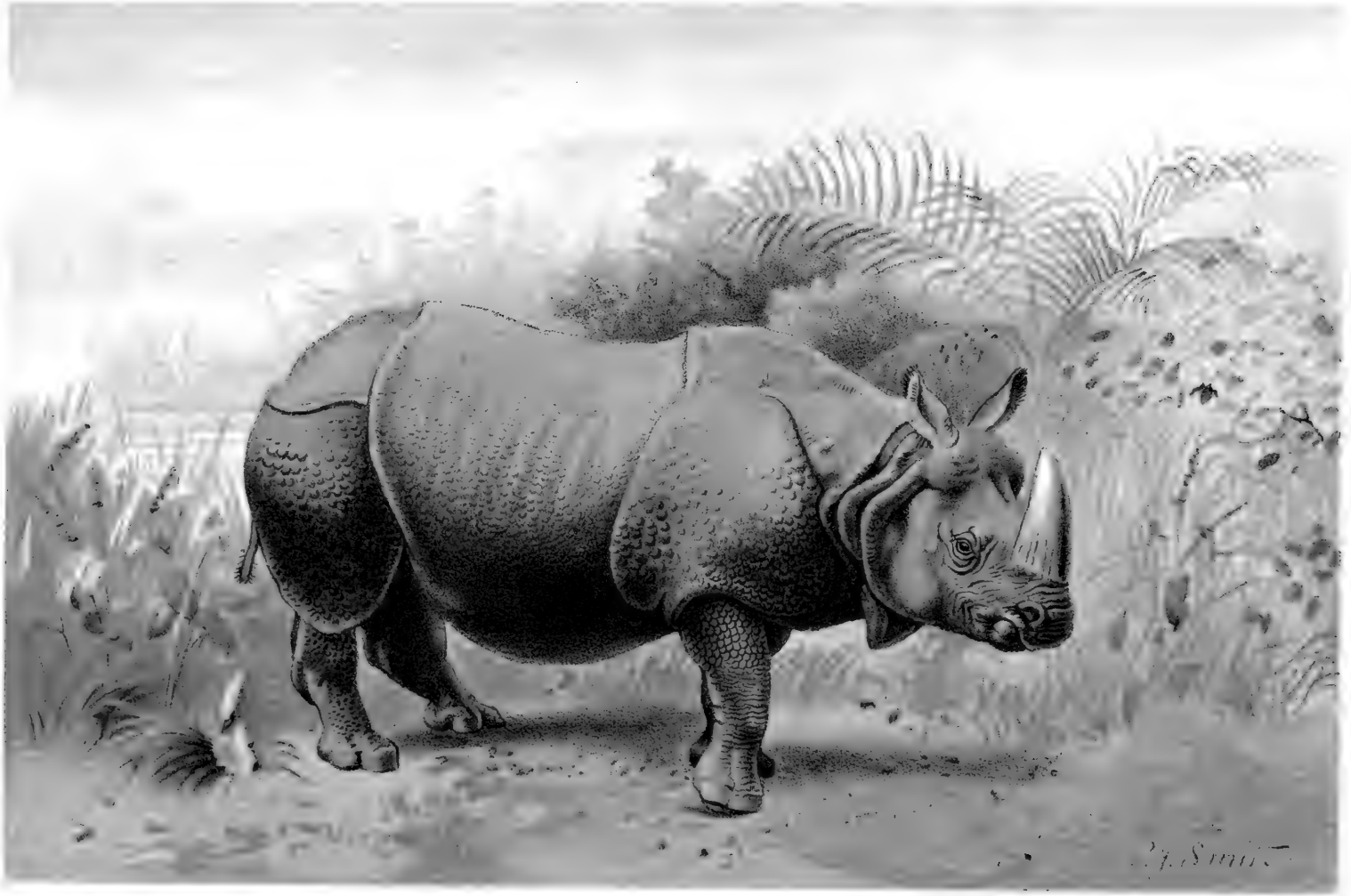


LEFT UPPER MOLAR TEETH OF TWO EXTINCT SPECIES OF RHINOCEROS.
Both considerably worn by use.

As regards their front teeth, the different species of rhinoceros present a considerable amount of variation, some of them having such teeth in both jaws, while in others they are totally absent; but there are never any canine teeth or tusks in the upper jaw, and the number of upper incisor teeth never exceeds two pairs. In the lower jaw there may be a pair of large pointed and nearly horizontal tusks, and between them a small pair of incisor teeth.

Form. All the living rhinoceroses are animals of large size and heavy build, with the legs comparatively short and stout, although less so than in the hippopotamus. Each of the toes is furnished with a relatively small, but broad and well-defined hoof-like nail. The head is large and elongated, with a concave profile, and the erect oval ears placed very far back. The eyes are very small in proportion to the size of the head; and the upper lip is generally, although not invariably, prehensile, and prolonged beyond the extremity of the lower one. The thick skin is either naked, or but sparsely clad with hair, and may be thrown in certain parts of the body into a series of deep folds. The tail is thin and of moderate length.

Horns. The horns, which form the characteristic feature of the physiognomy of the living species, are composed of a closely-packed mass of horny fibres, growing from the skin, and having no connection with the bones of the skull, although there are prominences on the latter beneath each horn. The skull, as shown in the figure of that of an extinct species given in the sequel, is characterised by its elevated occipital region, long curved profile, the absence of



INDIAN RHINOCEROS.

any bony bar at the hinder part of the socket of the eye, and the large size of the nasal bones, which are completely fused together. In those species with but one horn this is carried upon the nasal bones, and the front horn of those with two of these appendages has a similar situation; but the second horn, when present, is placed on the frontal bones.

Habits. Rhinoceroses are stupid and somewhat timorous beasts, generally striving to escape from man, although when brought to bay exceedingly fierce, and consequently from their great size very dangerous. Although the African species are entirely dependent on their enormous horns, as weapons of offence and defence, the Asiatic kinds, in which the horns are smaller, seem to rely chiefly upon their sharply-pointed lower tusks, which are capable of inflicting terrific gashes. All are mainly nocturnal; and while some resemble the tapirs in frequenting tall grass-jungles and swampy districts, others seem to prefer more or less open plains. Their food is entirely vegetable; but whereas some species subsist almost exclusively on grass, the food of others consists mainly of twigs and small boughs of trees; this difference in diet being correlated with a difference in the structure of the molar teeth. At the present day these animals are restricted to South-Eastern Asia and Africa: and they may be divided into two main groups according to their geographical distribution, the Asiatic group being again subdivided into two minor groups.

The Asiatic Rhinoceroses.

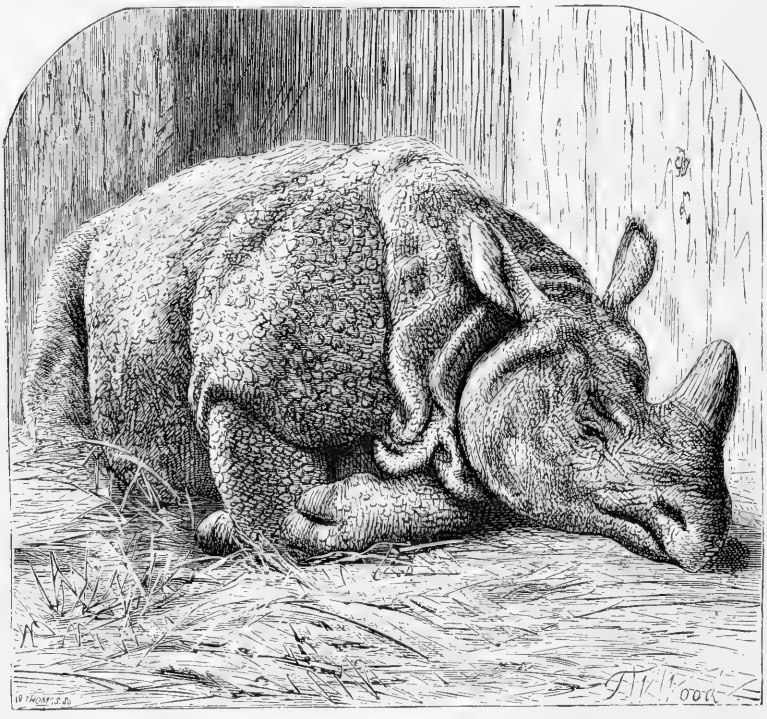
The whole of the three species of rhinoceroses inhabiting Asia are characterised by the skin being thrown in places into thick folds, and by the presence of teeth in the front of the jaws; the horns being either one or two in number.

Indian Rhinoceros. By far the largest of these three is the great one-horned Indian rhinoceros (*R. unicornis*), which may be conveniently designated as the Indian rhinoceros *par excellence*, and is the one which has been longest known in Europe from living examples, a specimen having been sent to Portugal as long ago as the year 1513. In this species there is but a single nasal horn; and the skin, with the exception of that of the tail and ears, is naked, and on the sides of the body studded with a number of large convex tubercles, reminding one of the rivets in an iron boiler, which are largest on the fore and hind-quarters, where they may be as much as an inch in diameter. The skin of the body is divided into a number of shield-like pieces by the aforesaid folds. Thus there is a fold before and behind each shoulder, marking off a large triangular shield covering the shoulder; and another in front of each thigh dividing the large saddle-shaped body-shield from the one on the hind-quarters. The folds behind the shoulder and in front of the hind-quarters continue completely across the back, but the one in front of the shoulder inclines backwards and dies out close to the second great fold. Other folds form great rolls of skin on the neck, while there are others below the shields on the fore and hind-quarters and one situated behind the buttocks which forms a groove for the reception of the tail. The head is very large in proportion to the body, with the occipital region of the skull very much elevated; and the ears are large, with their tips fringed with hairs. The horns are large in

both sexes; and the colour of the skin is a uniform blackish grey. In height the Indian rhinoceros stands from 5 feet to $5\frac{3}{4}$ feet at the shoulder. In a male standing 5 feet 9 inches at the shoulder, measured by General Kinloch, the length from the tip of the snout to the root of the tail was 10 feet 6 inches, the length of the tail 2 feet 5 inches, and the girth of the body 9 feet 8 inches. The length of the horn is seldom more than a foot, although Jerdon says that there are instances on record of horns of 2 feet in length, and one in the British Museum measures 19 inches.

Teeth.

The Indian rhinoceros is further characterised by its teeth. As a rule, there is but a single pair of broad incisors in the upper jaw, although in some cases there may be a smaller pair behind them. In the lower



GREAT INDIAN RHINOCEROS IN THE ZOOLOGICAL GARDENS.

jaw there is one pair of long, triangular, pointed tusks, and between them a pair of small cylindrical incisors which can be of no functional importance. The upper molar teeth have tall crowns, and in the absence of a buttress at their front outer angle, and the flat plane formed by their worn surface, resemble the one represented in the lower figure on p. 464. They are, however, distinguished from the latter by the presence of a small vertical plate, projecting from the outer wall into the extremity of the middle valley. It will be obvious that this flat plane of wear of the cheek-teeth implies that the jaws have a backwards-and-forwards grinding motion, and not a champing action; such a mode of mastication being similar to that existing in horses and cattle.

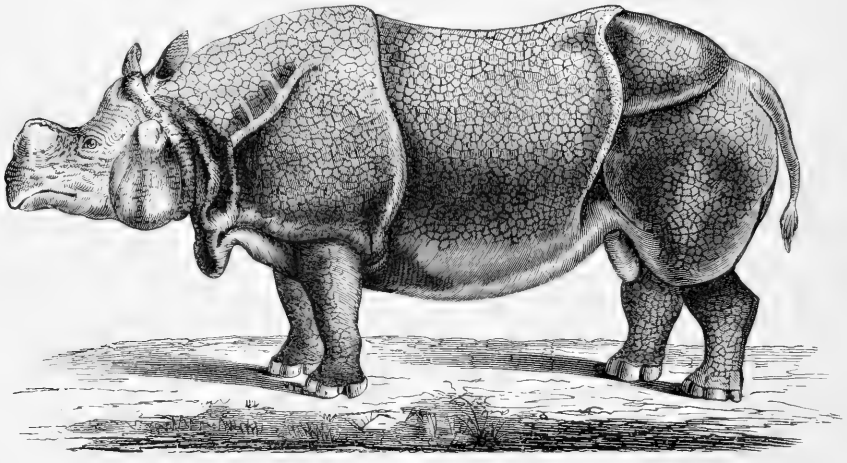
Distribution. This rhinoceros is exclusively confined to India, and at the present day, according to Mr. Blanford, is almost restricted to the Assam plain, being rarely, if ever, found to the westward of the Tista River. Twenty or thirty years ago, it was, however, still common in the so-called terai country at the foot of the Sikhim Himalaya, while some years earlier it frequented the sub-Himalayan districts of Nipal, and ranged as far west as Rohilcund; while the writer last quoted believes that, about the year 1850, it also occurred in the grass-jungles of the Ganges valley at the north end of the Rahmahal Hills in Bengal. In the early part of the sixteenth century it ranged over the Punjab as far westwards as Peshawur; and since its fossilised remains are found in the North-West Provinces, the Narbada valley, and Madras, it may be inferred that the Indian rhinoceros formerly ranged over the greater part of Peninsular India, in localities suited to its habits.

Habits. The Indian rhinoceros is a denizen of the great grass-jungles that cover such a large portion of the plains of India, and from this circumstance, coupled with the general resemblance of its molar teeth to those of the African Burchell's rhinoceros, which is known to be a grass-eater, it may be assumed that its food is chiefly grass. Regarding the density and height of these jungles, General Kinloch writes that, "year after year, in the short space of two or three months, these giant grasses shoot up to a height of from twenty to thirty feet, forming, with the wild cardamum, various other broad-leaved plants, and numerous creepers, a tangled cover which shelters the elephant, the rhinoceros, and the buffalo, as effectually as a field of standing corn affords concealment to the partridge or the quail. I have seen a line of about fifteen elephants beating a strip of reeds not more than two hundred yards in width, and I could hardly see the grass shake. There was not as much commotion or indication of what was going on, as would be caused by a pack of beagles drawing a gorse-cover. Runs or tunnels among the high reeds, like magnified 'meuses' of hares and rabbits, show that the same paths through the thick jungle are generally made use of."

The rhinoceros chiefly frequents such portions of these grass-jungles as are on swampy ground; and although it is in general a solitary animal, the writer just quoted states that he has known half a dozen individuals roused from a belt of not more than half a mile in length by three hundred or four hundred yards in width. Like tapirs, the Indian rhinoceros is fond of a mud-bath. Although there are many stories extant as to its ferocity, and more especially its enmity to the elephant, it appears that this animal is generally quiet and harmless. Even when wounded, according to Mr. Blanford, it is but seldom that it charges home; but when it does attack, the sharp lower tusks are used much after the same manner as those of a wild boar. The only sound that this rhinoceros utters is a peculiar grunt, which is repeated at frequent intervals during excitement. The usual gait of this rhinoceros is a long swinging trot, but when disturbed, it can break into an awkward but very rapid gallop. Only a single calf is produced at a birth, but there is some uncertainty as to the length of the period of gestation, an old writer stating that it is nine months, while a more recent authority affirms that it is nearly or quite double as long. Since rhinoceroses, so far as we are aware, have

not bred in captivity in Europe, the point is one not likely to be soon cleared up. The Indian rhinoceros thrives well in confinement, and frequently lives in that state for a long period. One specimen acquired by the London Zoological Gardens in 1834 lived till 1849, while a second, purchased in 1850, died in 1874, and a third presented in 1864 is still (1894) flourishing. Mr. Blanford states that he has heard of captive specimens living fifty or sixty years, and Mr. Brian Hodgson was of opinion that the natural term of this animal's life is upwards of a century.

From the immense thickness and apparent toughness of its enormous folds, it was long considered that the hide of the Indian rhinoceros was bullet-proof, and that the only places where the animal was vulnerable were the joints of the armour. General Kinloch relates an amusing story of a soldier in India, who had heard of this legend, firing point-blank at a tame rhinoceros which had been captured by his regiment during the Mutiny, in order to obtain ocular proof of its



GREAT INDIAN RHINOCEROS.

truth. Needless to say, as the shot was well aimed, the unfortunate animal fell dead, which meant a considerable loss to the regimental prize-fund. And we may mention here that the Indian rhinoceros, like all its kindred, when shot sinks down in its tracks, and lies as if asleep, instead of falling over on its side like most other mammals.

As a matter of fact, the skin of the living animal is quite soft, and can readily be penetrated in any place by a bullet, or easily pierced by a hunting-knife. When dried it becomes, however, exceedingly hard; and it was formerly employed by the Indian princes in the manufacture of shields for their soldiery. General Kinloch states that if polished the hide "is very handsome and semi-transparent, and when held up to the light looks exactly like tortoise-shell, the tubercles giving it a beautiful mottled appearance."

The horn is used by the Hindus (to whom in common with the natives of most parts of India, the animal is known by the name of *gainda*) in some of their religious ceremonies; when manufactured into cups it is considered by the Chinese to possess the property of indicating the presence of poison.

Hunting. There are two modes, according to General Kinloch, of hunting the Indian rhinoceros—"one by quietly tracking up the animal on a single elephant until he is at last found in his lair, or perhaps standing quite unconscious of danger; the other, by beating him out of jungle with a line of elephants, the guns being stationed at the points where he is most likely to break cover. In the latter case it is necessary to have reliable men with the beaters, who can exercise authority and keep them in order, for both mahouts and elephants have the greatest dread of the huge brute, who appears to be much more formidable than he really is."

The same writer gives his experience of rhinoceros-hunting as follows. On a certain occasion the General and his party "had tracked a wounded buffalo into a large and very thick cover, into which it was useless to follow him with any chance of getting a shot. The three guns, therefore, went on ahead, and took up their positions at the other end of the cover, while the pad-elephants were ordered to form line and beat steadily through the jungle. After waiting a long time at my post I heard some large animal crashing through the reeds, and as the line of beaters advanced the waving of the grass betrayed its movements. It came on very slowly, occasionally stopping for some time to listen, and again making a cautious advance. I remained still as death, but I was in a great state of anxiety lest my elephant should become uneasy and give the alarm. Fortunately, he remained silent, and at length the rhinoceros, anticipating no danger ahead, and pressed by the steadily advancing line of elephants behind him, poked his ugly head out of the reeds within twenty yards of me. I could only see his snout and his horn, and aimed above the latter for his forehead. I either took a bad aim, or my elephant moved slightly as I fired, for, as I afterwards found, my bullet merely grazed the snout, cutting a deep furrow along the base of the horn. As the rhinoceros wheeled round, I gave him another bullet in the centre of his ribs, and he rushed back into the reeds and through the beaters with an angry grunt." On search being made in the jungle, it was found that the second bullet had done its work, the huge animal lying dead with its legs folded beneath the body in the usual recumbent posture.

Javan Rhinoceros. The Javan, or lesser one-horned rhinoceros (*R. sondaicus*), is an altogether smaller animal than the preceding, with the head relatively less large in proportion to the body, although its height at the shoulder is scarcely, if at all, inferior. The skin, which is nearly or quite naked, lacks the large tubercles of the Indian rhinoceros: while the fold in front of the shoulder, instead of inclining backwards, is continued right across the body like the other two main folds. Superficially, the skin is divided by a network of cracks into a number of small mosaic-like discs. The great folds of skin which are so conspicuous in the neck of the Indian rhinoceros are in this species much less strongly developed. The general colour is a uniform dusky grey. The skull is less elevated than in the larger species in the occipital region: but there are the same number of front teeth. In structure the upper molar teeth are, however, simpler, resembling the lower of the two figured on p. 464; and their crowns are not so tall. Measurements of wild individuals appear to be very few: but in a large female the height at the shoulder was $5\frac{1}{2}$ feet. The female is generally or invariably hornless.

Distribution. This species has a much more extensive distribution than its larger cousin. There is no evidence that it ever occurred in Peninsular India, but it is found in the Bengal sundarbans and portions of Eastern Bengal, while it has been met with in the Sikhim "terai." From the valley of Assam it ranges eastwards through Burma and the Malay Peninsula to Sumatra, Java, and Borneo; its partially fossilised remains occurring in the latter island.

Habits. Mr. Blanford observes that this species "is more an inhabitant of the forest than of grass, and although it is found in the alluvial swamps of the sundarbans, its usual habitat appears to be in hilly countries. It has been observed at considerable elevations both in Burma and Java." Indeed, there is evidence that it probably ascends occasionally to as much as seven thousand feet above the sea-level. This species being a forest-dwelling one, while its molar teeth are of the same pattern as those of the leaf and branch-eating common African rhinoceros, it is pretty certain that its food must be of the same general nature as that of the latter. In disposition the Javan rhinoceros is said to be more gentle than the large Indian species, and it is not unfrequently tamed by the Malays. The horns are never large, and afford but poor trophies to the sportsman.

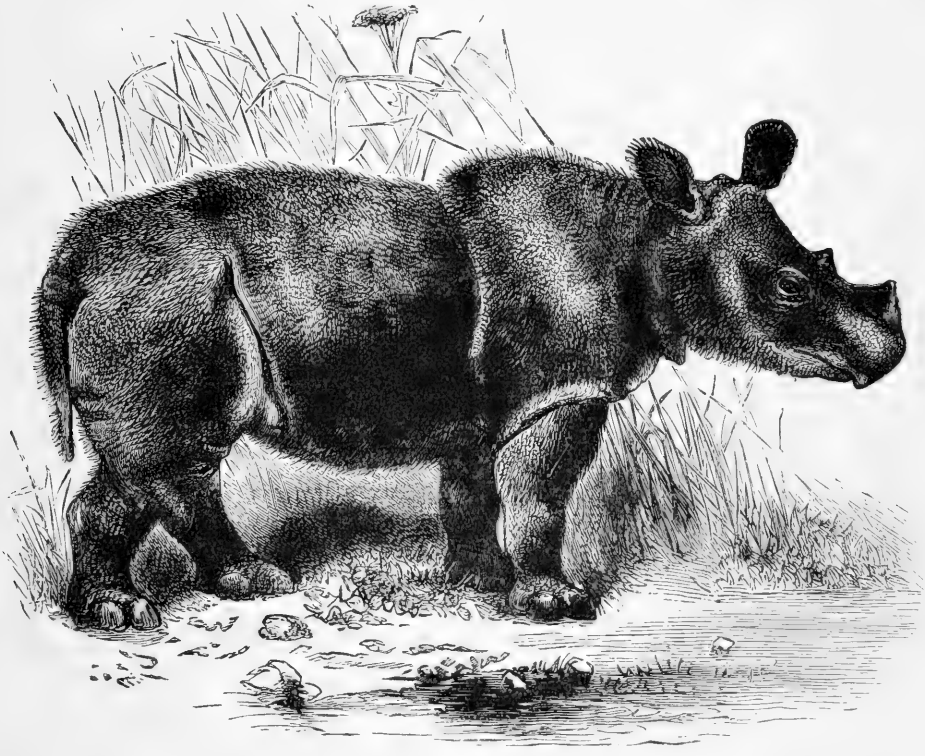
Allied Siwalik Rhinoceroses. In the Pliocene rocks of the Siwalik Hills at the foot of the Himalaya there occur remains of a single-horned rhinoceros (*R. sivalensis*), which appears to have been closely allied to the Javan species, of which the original home may accordingly have been India. More remarkable, however, is the occurrence of a fossil rhinoceros in the interior of the Himalaya, at an elevation of about sixteen thousand feet above the sea-level, which likewise seems to have been related to the same species. It may be added that another fossil Indian rhinoceros (*R. palæindicus*), of which an upper molar teeth is represented in the lower figure on p. 464, appears to have been the forerunner of the living great Indian rhinoceros; its molar teeth approximating to those of the latter, although of a rather less complex structure.

Sumatran Rhinoceros. Reverting to the living Asiatic species, the last of all is the Sumatran rhinoceros (*R. sumatrensis*), which is mainly characteristic of the countries to the eastward of the Bay of Bengal, occurring but rarely in Assam, although a single example has been obtained from Bhutan. From Assam it ranges through Burma and the Malay Peninsula to Siam, Sumatra, and Borneo: but it is quite unknown in Java.

Characters. This is the smallest of all the living species of rhinoceros, and differs from the preceding kinds in carrying two horns. It is further distinguished by its hairiness, although there is a certain amount of individual variation in this respect. As a rule, the greater part of the body is thinly covered with brown or black hair of considerable length, while there are larger or smaller fringes of hair on the ears and tail. The skin, which is rough and granular, and varies in colour from earthy brown almost to black, has the folds much less developed than in the single-horned species, and only the one behind the shoulders is continuing right across the back. The two horns are placed some distance apart, and when fully developed are thick and massive at the base, but very slender above, the front and longer one sweeping backwards in a graceful curve. In

many specimens the horns are, however, very short, and in examples kept in confinement like the one from which our figure is taken, they become worn down to mere stumps. The Sumatran rhinoceros differs from its two Asiatic cousins in having lost the pair of small incisor teeth in the lower jaw, in the front of which only the tusks remain, and even these are sometimes shed in old age. In these respects, therefore, this species, concomitantly with the presence of two horns, shows an indication of approximating to the African rhinoceroses.

In addition to the variation in the degrees of development of the hair, this species



THE SUMATRAN RHINOCEROS.[1]

The horns, as in most captive specimens, are abnormally short.

shows considerable individual differences in colour, and also in the relative breadth of the skull. A specimen purchased in 1872 by the Zoological Society of London for over a £1000, and exhibited in their gardens, differed from the ordinary form by its superior size, paler and browner colour, smoother skin, shorter and more thickly-tufted tail, and the longer, finer, and more reddish-coloured hair; the latter forming a long fringe on the ears, of which the insides were naked. This animal had also a much wider head than ordinary. It was accordingly regarded as a distinct species, under the name of the hairy-eared rhinoceros (*R. lasiotis*); but there is little doubt that it cannot be considered as anything more than a well-marked variety of the Sumatran species.

There is considerable variation in regard to the dimensions of this species, but

[1] Messrs. Macmillan & Co. have favoured the Editor with this figure.

Mr. Blanford considers that from 4 feet to 4½ feet will represent about the average height at the shoulder. In the above-mentioned specimen the height at the shoulder was 4 feet 4 inches, and the length from the tip of the snout to the root of the tail 8 feet; the weight of the animal being about 2000 lbs. On the other hand, in an adult female from the Malay Peninsula, the shoulder-height was only 3 feet 8 inches. There is also great variation in regard to the length of the horns, the hinder one being in some cases reduced to an almost invisible knob. Mr. E. Bartlett gives the following particulars of Bornean specimens. In one example the front horn was 4½ and the second 2 inches in length; in a second, while the front horn measured 5 inches, the hind one was a mere knob; and in a third, the front horn had a length of 19 inches with a girth of 16 inches, the second horn being fairly developed, although not more than about 3 inches in height. A single specimen of a front horn had a length of 11 inches, with a basal girth of 11½ inches; but the maximum recorded length is upwards of 32 inches along the curve.

Habits. The molar teeth of this species are almost indistinguishable from those of the Javan rhinoceros, and as its habits appear to be very much the same as those of the latter, the diet of the two is probably also similar. The Sumatran rhinoceros inhabits hilly forest-districts, and it has been observed in Tenasserim at an elevation of four thousand feet above the sea. It is a good swimmer, and is reported to have been seen swimming in the sea in the Mergui Archipelago. Although shy and timid in the wild state, in captivity it soon becomes tame.

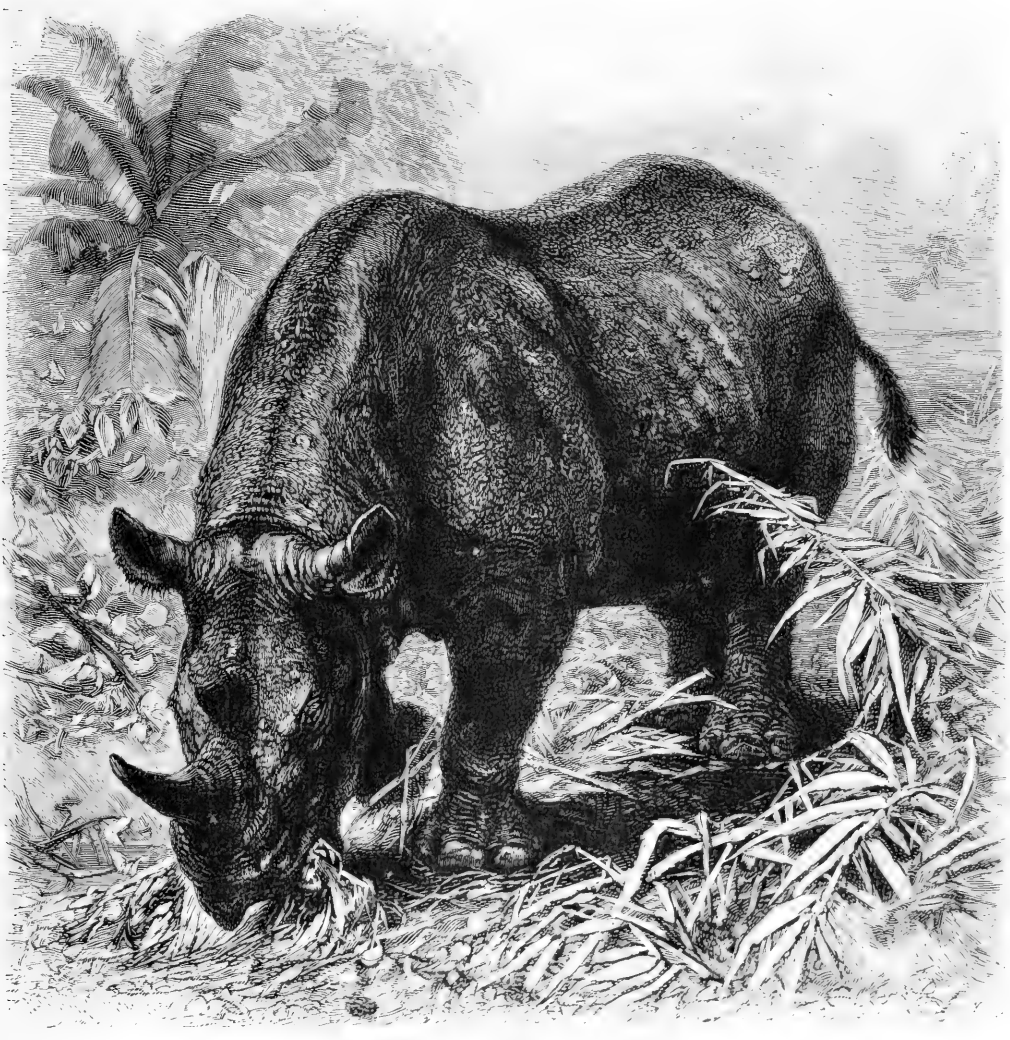
Mr. E. Bartlett states that in Borneo the dyaks are very partial to the flesh of this species as an article of diet. And he adds that the kyans—a race very distinct from the dyaks—procure the horns for barter, for which they receive a high price from the Chinese, who import them to China for medicine. The horns are ground into powder for some diseases, while others are cut into minute fragments to carry about the person. The same writer further states that this rhinoceros is becoming extremely rare in the province of Sarawak, on account of the value set upon its horns, but in Central and North Borneo in the very old jungle it is more plentiful.

In 1872 a Sumatran rhinoceros, recently imported into London, gave birth to a calf; and this event afforded Mr. A. D. Bartlett data for considering that the period of gestation was a little over seven months. This however, as Mr. Blanford points out, seems a very short period for such a large animal, and contrasts very markedly with the length of time assigned by Hodgson to the great Indian rhinoceros.

Allied Extinct Species. No fossil species allied to the Sumatran rhinoceros has hitherto been obtained from the Tertiary deposits of India, whence we may conclude that the latter is probably a comparatively recent immigrant into North-Eastern India. Schleiermacher's rhinoceros (*R. schleiermacheri*) of the Miocene and lower Pliocene deposits of France and Germany appears, however, to have been very closely allied to the Sumatran species; and thus affords, in common with some other fossil mammals, evidence of an eastward migration of types formerly inhabiting Western Europe.

African Rhinoceroses.

Although it is commonly reported by hunters, who in many cases derive their information from native sources, that there are several kinds of rhinoceros inhabiting Africa, we have at present definite acquaintance with only two species, namely, the common African rhinoceros, frequently spoken of as the black



THE COMMON AFRICAN RHINOCEROS ($\frac{1}{29}$ nat. size).

rhinoceros, and the square-mouthed, or Burchell's rhinoceros, commonly termed the white rhinoceros. Since there is but little, if any, marked difference in the colour of the two animals, the names founded on this character are best discarded. It is possible, however, that a third species may inhabit East Africa.

Characters. Both species are furnished with two horns, which attain a greater development than in either of their Asiatic relatives. From

all the latter the African rhinoceroses are distinguished by the absence of any permanent folds in the skin, and also by the want of both incisor teeth and tusks in the adult state; such teeth if they occur even in the young being rudimentary and functionless. In consequence of this want of front teeth, the extremities of both the upper and lower jaws are much shorter than in the Asiatic species. Moreover, whereas in the latter the nasal bones are narrow and terminate in a point, in the African rhinoceroses they are rounded and truncated in front. In both kinds the skin of the body is almost entirely naked and comparatively smooth; but there is generally a little fringe or tuft of hairs on the ears and tail.

Common African Rhinoceros. The common African rhinoceros (*R. bicornis*) is the smaller of the two species, and is also the one which has by far the wider distribution, extending, in suitable districts, through Eastern and Central Africa, from Abyssinia in the north to the Cape Colony in the south. From the character of the upper lip this species is sometimes spoken of as the prehensile-lipped rhinoceros, while in Southern and Eastern Africa it is variously termed the boreli or upetyani, the keitloa, and the kulumani; these different native names, as we shall notice later, referring to differences in the relative proportions of the two horns. This species is best characterised by the pointed and slightly prehensile upper lip, the small and rounded nostrils, and the position of the eyes being a little behind the continuation of the axis of the second horn. The ears are of moderate length, and furnished with a fringe of hair along the upper edge, while in some cases they are rounded above, although in others more pointed. There is a considerable amount of individual variation as to the length and amount of the fringe of hairs on the margins of the ears. The molar teeth of this rhinoceros are of the type of the uppermost of the two represented on p. 464. That is to say, they have comparatively low crowns, a well-marked buttress at their front outer angle, the middle valley not divided into two moieties by a cross-partition, and the surface of the crown when worn raised into two distinct ridges. The latter feature shows that the jaws have a somewhat champing, instead of a completely grinding action; and since we know that this species feeds almost exclusively on twigs and leaves, it may be assumed that molar teeth of this pattern always indicate a similar diet for their owners. The horns are well developed in both sexes.

HEAD OF THE COMMON AFRICAN RHINOCEROS.

As regards dimensions, in an adult female from Abyssinia described by Mr.

Blanford, the length of the tip of the snout to the end of the tail measured along the curves was 6 feet 9 inches, of which 1 foot 9½ inches was occupied by the tail, and the height at the shoulder 4 feet 8½ inches. These dimensions are, however, exceeded by males, which, according to Sir S. Baker, may stand from 5 feet 6 inches to 5 feet 8 inches at the shoulder.

The proportions of the two horns to one another vary greatly, the front one being in some cases much longer than the hinder, while in others the two are nearly or quite equal, and, more rarely, the second horn may be the longer of the two. The native name boreli is applied to those individuals in which the second horn is the shorter, while keitloa is restricted to such as have horns of equal length, or the second longer than the first. Mr. Selous has shown that there is a complete transition from the one to the other type, and consequently that such differences cannot have any specific value.

Size of Horns. In regard to the length attained by the horns of this species, it appears that in Abyssinia and other parts of North-East Africa, from Sir S. Baker's experience, the front horn rarely or never exceeds 23 or 24 inches, but much larger dimensions are recorded in South and East African specimens. Thus examples of the front horn are described as measuring 44, 43, 41, 40, and 38½ inches in length; but with the exception of the last, in which its length is 21 inches, in none of these examples are the dimensions of the second horn recorded. In one specimen the length of the first and second horns were respectively 31 and 19½ inches, in another 28¾ and 15¼, in a third 28¼ and 8⅜, in a fourth 27 and 16½, in a fifth 21½ and 18¾, and in a sixth 14⅝ and 14¾ inches. The front horn is generally nearly circular in section and slightly curved backwards, while the second is nearly straight, much compressed, and with its hinder edge often sharper than the front one. Sir J. Willoughby killed in East Africa an example of this rhinoceros having a small rudimental third horn behind the normal pair.

Habits. In Abyssinia Mr. Blanford states that this rhinoceros is confined to the lower elevations, not ascending above some five thousand feet. In the valley of the Anseba he writes that it "inhabits the dense thickets on the bank of the stream, which are intersected in all directions by the paths made by these animals. In the densest parts, where roots and stems render the jungle almost impervious, there are places known by the inhabitants as rhinoceros-houses. The stems and branches have generally been broken away or pushed back, so as to leave a clear space, about fifteen or twenty feet in diameter, at the bottom of which the ground has been worn into a hollow by the trampling and rolling of the animal in wet weather. These houses are used as retreats during the heat of the day. On two or three occasions we disturbed a rhinoceros from one of these, and he rushed off with much noise and loud snorts through the bushes. So far as we could learn from our observations, these animals enter the thick jungle early in the morning and rest until one or two o'clock in the day, then they leave their thickets and go out to feed, usually remaining, however, amongst high bushes. At the time of year in which we visited the country, rain generally set in in the afternoon, and, even if it did not rain, the sky was overcast. In the clear weather the rhinoceroses are said never to appear before evening. They are great browsers, feeding chiefly on the young shoots and branches of acacia and other trees, or on fruits; so far as I

could see, they do not generally eat grass. Their movements are very quick, their usual pace being a smart trot, and the numerous tracks show that they move about a good deal." After expressing his doubts as to the statements of the natives that a man on horse cannot escape from one of these animals, Mr. Blanford adds that "they are easily eluded by turning, as they are not quick of sight, and, like most mammals, they never look for enemies in trees; consequently, a man two or three feet from the ground will remain unnoticed by them if he keeps quiet. They are said to be extremely savage, and unquestionably the first one killed by us charged most viciously. . . . I cannot help thinking, however, that their savage disposition has been somewhat exaggerated." Most of these animals seen by the members of the Abyssinian Expedition were in pairs,—an old female with a nearly full-grown calf,—but on one occasion four were observed. Mr. Blanford compares the snort of alarm or rage uttered by these animals when disturbed to the noise of a locomotive rather than to the sound of any other animal.

The foregoing account is confirmed in all essential particulars by the observations of Mr. Selous in South-Eastern Africa, who writes that this species of rhinoceros "lives exclusively upon bush and roots, eating not only the young leaves as they sprout from the end of a twig, but also chewing up a good deal of the twig itself. It is owing to the fact that this species lives upon bush that its range is very much more extended than that of the square-mouthed rhinoceros; for there are many large districts of country in the neighbourhood of the Zambesi to the eastward of the Victoria Falls covered almost entirely with an endless succession of rugged hills, almost devoid of grass, though well wooded, in all of which districts the prehensile-lipped rhinoceros is numerous, as it thrives well upon the scrubby bush with which the hillsides and valleys are covered; whereas the square-mouthed species, though common in the forest-clad sand-belts and broad grassy valleys which always skirt the hills, is seldom or never found among the hills themselves, which is doubtless because the pasturage is too scanty to enable it to exist."

The same writer also tells us that this rhinoceros, like the larger African species, exhibits extraordinary activity in getting over hilly and rocky ground, and that it can traverse places which at first sight appear utterly impracticable for an animal of its bulky and apparently clumsy build. We also learn from the same observer that while the present species of rhinoceros always walks with its nose carried high in the air, the other kind walks with its muzzle close to the ground. Again, whereas in the common species the calf invariably follows its mother, the offspring of Burchell's rhinoceros as constantly precedes its parent.

Mr. Selous agrees with Mr. Blanford that the ferocity of the prehensile-lipped rhinoceros has been much exaggerated, and he is, indeed, inclined to regard it as an animal of a rather cowardly, if not exactly peaceable, disposition. It must, however, be borne in mind that those sportsmen who have attributed a ferocious disposition to this species, always make a distinction in this respect between the boreli and the keitloa, and give to the latter a much better character than they assign to the former. Whether any difference in this respect is really associated with the variations to which these names refer, we are not prepared to say (although it seems most unlikely); but it is important to notice that even those who attribute extreme ferocity of disposition to some individuals of this species have never

asserted that this applies to all. Mr. Selous states that he was only once charged by a common rhinoceros, and this after strong provocation, and even then the animal did not charge home; and he considers that vicious individuals are comparatively few and far between. "These animals," writes the same observer, "are very quick and restless in their movements, and either very inquisitive or mistrustful of their eyesight, for usually, when disturbed by anyone approaching from below the wind, they will jump up with a snort, gaze fixedly at the intruder, then, with another snort, trot quickly a few steps nearer, stand again, move their heads with a quick motion, first to one side then to the other, advance again perhaps, and finally, when shouted at, whisk quickly round and trot away in grand style, with tail screwed up over their backs." Recounting his experiences in Mashonaland, where he sometimes met with five, six, or even eight in a day, Mr. Selous says that whenever these animals met his wind, they invariably made off at once, but when they only saw him, they acted in the manner above described. On occasions of the latter kind the Kaffirs would take refuge up the nearest tree, and would urge their master to do likewise. He, however, always stood his ground, and found that although the rhinoceroses would sometimes advance in his direction from about forty to twenty yards' distance, yet, that if he threw stones or assegais at them, or even simply shouted, they always eventually turned tail and fled. If, however, a rhinoceros is fired upon when thus facing a man, it will, after dropping upon its knees, very often spring up and rush straight forwards; but Mr. Selous attributes such action not to any intention of making a charge, but merely to the animal being maddened by the shock and rushing blindly ahead; and he considers that it is thus that many of the accounts of its fierceness and aggressiveness have originated. He adds, however, that one of these animals when in full career, and either wounded or tired, will not hesitate to charge any obstacle that may be in its path, even a waggon and a team of oxen. Finally, Mr. Selous states that he believes the pursuit of the common African rhinoceros to be attended with less danger than that of either the lion, elephant, or buffalo; and he supports this opinion by observing that both Kaffirs and Hottentots, who but seldom care to molest a lion, never have the slightest hesitation in attacking a rhinoceros. The foregoing account is confirmed in all essential particulars by Sir John Willoughby, who suggests, however, that the rhinoceros is apt to be dangerous at certain seasons.

In South-Eastern Africa Mr. Drummond states that both species of rhinoceros generally leave their lairs about four o'clock in the afternoon, or, in districts where there are many human beings, somewhat later. They commence feeding in the direction of their drinking-places, to which they travel by regular beaten paths, and arrive at the same somewhere about dark. If the drinking-place is a mud-hole they frequently refresh themselves with a roll, after drinking their fill. They then start for their favourite thorn feeding-grounds, where they remain till day-break, when they generally again drink. At an earlier or later hour after this, the time being to some extent dependent on the freedom of the district from human intrusion, they retire to their sleeping-places, which they reach at any rate before the heat of the day. The lair is always in an extremely sheltered and deeply-shaded spot, and so heavily do they slumber that a practised stalker could almost touch them with the muzzle of a gun, unless they are awakened by the birds which

accompany them in search of the ticks with which they are infested. Mr. Hunter states, however, that in the Kilima-Njaro district rhinoceroses lie out in the open plain during the day.

The common rhinoceros is met with in Southern Africa generally either solitary or in family-parties of two or three. In the latter case it is usually a female accompanied by her calf; but Sir J. Willoughby met a male, female, and half-grown calf together, and as in this instance the horns of the male were much shorter than those of the female, it may be that the longer horns generally belong to the latter sex. Occasionally several full-grown individuals are seen together, Mr. Drummond stating that on one occasion he met with a party of six or seven. Sir J. Willoughby relates that once he shot one of a pair of these rhinoceroses, which was immediately fiercely attacked and rolled over by its companion. When a cow rhinoceros is killed, the calf generally remains by the dead body of its parent, from which it can with difficulty be dragged away.

Hunting. Like most other large African animals, the common rhinoceros is rapidly decreasing in numbers from the incessant pursuit to which it is subjected in the southern and eastern portion of the continent. Writing in 1881, Mr. Selous said that it was still fairly common in South-Eastern Africa, although it had been nearly exterminated in the regions to the westward. Only a few then remained on the Chobi, while between that river and the Zambesi there were none, and the natives said that there never had been any in that district. Northwards of the Zambesi they were, however, again met with, and from thence they doubtless extend through the whole of Central Africa to Abyssinia and the Sudan. In the Kilima-Njaro district Sir J. Willoughby's party found these rhinoceroses very plentiful in 1886, having on one occasion seen as many as sixteen head during a single day's march.

In Southern Africa the common rhinoceros is hunted either by being followed up when out feeding on the plains, or by the hunter lying in wait at its drinking-places. In the Sudan the Hamram Arabs are, however, in the habit of chasing the rhinoceros on horseback, and of ham-stringing it by a dexterous stroke of a long two-handed sword. This sport, according to Sir S. Baker, tries the speed of the best horses, and that writer's account of the chase of a couple of these animals, which, after running more than two miles, defied further pursuit by escaping into thick cover, is probably known to many of our readers. An Arab hunter explained to Sir S. Baker, "that at all times the rhinoceros was the most difficult animal to sabre, on account of his extraordinary swiftness, and, although he had killed many with the sword, it was always after a long and fatiguing hunt, at the close of which the animal becoming tired generally turned to bay, in which case one hunter occupied his attention, while another galloped up behind and severed the hamstring. The rhinoceros, unlike the elephant, can go very well upon three legs, which enhances the danger, as one cut will not disable him." A less sporting method adopted by the Arabs of the same regions is to dig a hole about two feet deep by fifteen inches in diameter in the animal's run, and to place in the centre a rather elaborately-constructed snare, to which is attached a rope with a heavy log of wood at the other end. When the rhinoceros steps on the pit, one of its feet is caught in the running noose. When caught, the first effort of the rhinoceros is to

escape, and he forthwith pulls the log from the trench in which it was buried. This log, writes Sir S. Baker, "acts as a drag, and, by catching in the jungle and the protruding roots of trees, it quickly fatigues him. On the following morning the hunters discover the rhinoceros by the track of the log that has ploughed along the ground, and the animal is killed by lances or by the sword."

The same writer adds that the hide of a rhinoceros will produce seven shields; these being worth about two dollars each, as simple hide before manufacture. The horn is sold in Abyssinia for about two dollars per pound, for the manufacture of sword-hilts, which are much esteemed if of this material. In South Africa the flesh of the common rhinoceros is much appreciated by the natives as food; but as the animal never has any fat, the meat is somewhat dry.

Like other members of the genus, this rhinoceros appears to be long-lived even in captivity, a specimen from Nubia, acquired by the Zoological Society of London in 1868, having lived in the menagerie till 1891.

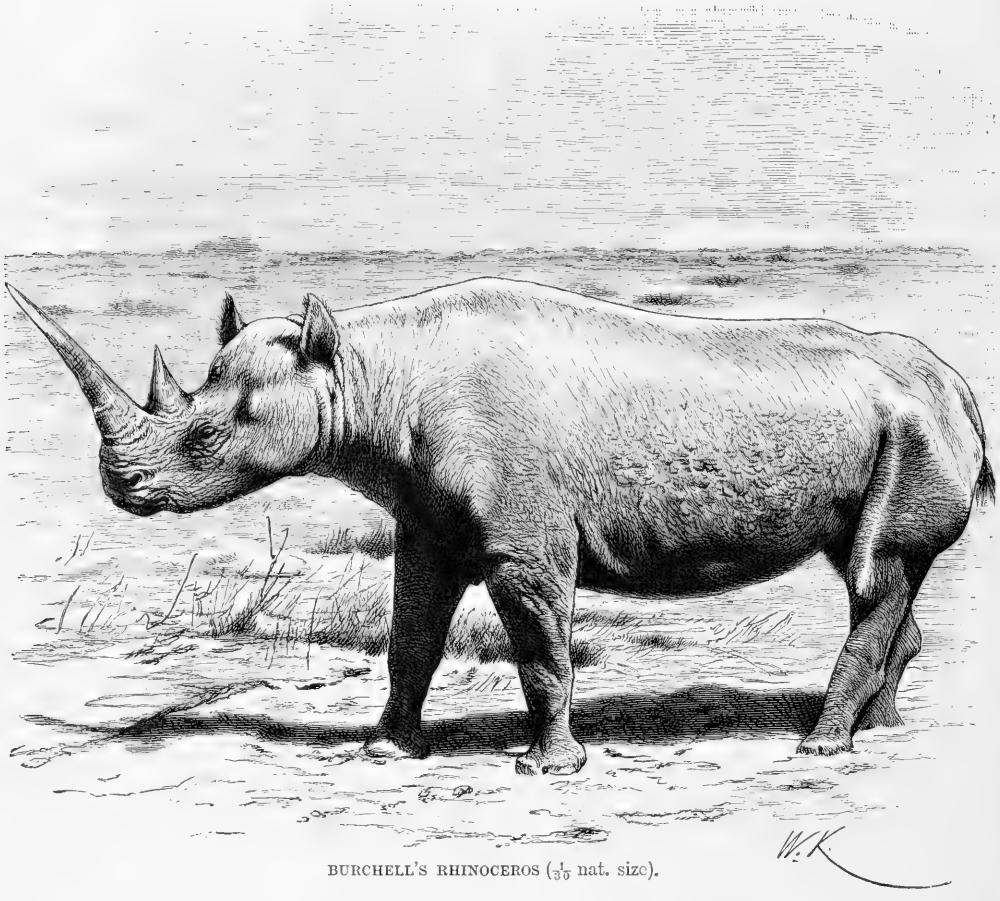
Extinct Ally. The immediate ancestor of this species appears to have been the extinct thick-jawed rhinoceros (*R. pachygnathus*), of which a series of finely-preserved remains have been obtained from the well-known fresh-water deposits of Pikermi, near Attica, belonging to the Pliocene period.

Burchell's Rhinoceros. The largest of the group is the square-mouthed, or Burchell's, rhinoceros (*R. simus*), commonly known as the white rhinoceros, which is now, alas, practically exterminated. In addition to its great size, this species is characterised by its bluntly-truncated muzzle and the absence of a prehensile extremity to the upper lip, as well as by the great proportionate length of the head, which in large specimens is more than a foot longer than in the common species. Moreover, the nostrils form long narrow slits; the eye is placed entirely behind the line of the second horn; and the ear is very long, sharply pointed at the extremity, where it has but a very small tuft of hairs, and has its lower portion completely closed for some distance, so as to form a tube. The front horn attains a greater length than in the common species. In the skull the extremity of the lower jaw forms a much wider and shallower channel than in the *R. bicornis*, and the structure of the upper cheek-teeth is different. These teeth resemble in general structure those of the great Indian rhinoceros, having very tall crowns, with flat grinding surfaces, no distinct buttress at the front outer angle, and the outer portion of the middle valley cut off by a partition. They are, however, quite peculiar among existing species, in having a large amount of cement investing the interior and filling up the valleys of the crown. Moreover, the third molar in the upper jaw, instead of being triangular in shape, closely resembles the tooth in front of it; a peculiarity found elsewhere only among certain extinct hornless species. In colour Burchell's rhinoceros differs but little from the common species, the general hue of both being a slaty grey.

Dimensions. In height this rhinoceros is known to reach $6\frac{1}{2}$ feet at the shoulder, and it is said that specimens were formerly obtained which slightly exceeded these dimensions. As regards length, our information is far from satisfactory. It has been stated that the length may be something between 18 and 19 feet; but this seems quite incredible, more especially as the proportions of our figure indicate that the length was rather more than double the height, which

would make it about 14 feet. One of the specimens referred to below has a length of 12 feet 1 inch, and a height at the shoulder of 6 feet 2 inches.

There is fully as much variation in the relative length of the horns as in the common species, the second horn being sometimes a mere stump, and at others attaining a length of 2 feet, while in some instances both are comparatively short. The front horn is, moreover, liable to considerable variation in shape. Thus, in the typical form of the species, it curves backwards in a more or less bold sweep, as shown in our figure of the head, the individuals exhibiting this form being



BURCHELL'S RHINOCEROS ($\frac{1}{30}$ nat. size).

known to the Bechuanas by the name of mohohu. In other cases, as shown in our illustration of the entire animal, the front horn is nearly straight, with a forward inclination, specimens with this type of horn being designated by the natives as the kabaoba. When the anterior horn is straight and attains the length of about a yard, the point touches the ground as the animal walks along when feeding, and such horns consequently always show a flat surface on the front of the tip produced by friction. It was at one time considered that the mohohu and the kabaoba were distinct species, but Mr. Selous has shown not only that they consort together, but that there is a complete transition from the one type of horn to the other. As a rule, the horns of females are longer and more slender than those of males.

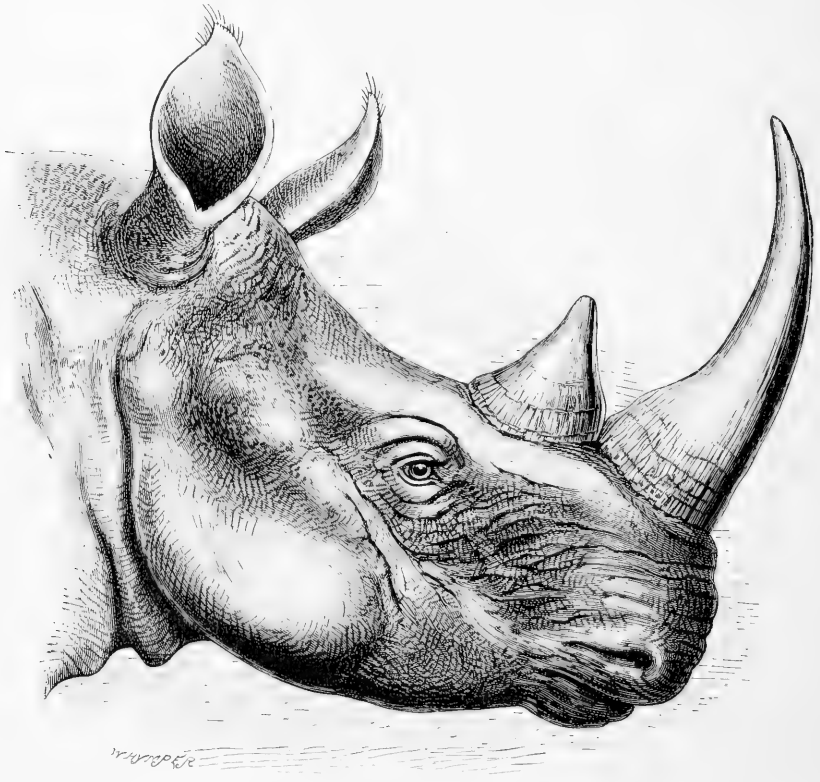
The longest known horn is one of the kabaoba type in the British Museum, of which the total length is $56\frac{1}{2}$ inches. The history of this specimen is unknown, but it has been in the collection for a very long period. Next to this is an example of the mohohu type recorded by Mr. Selous, of which the length is given as 54 inches. Other fine specimens of the front horn measure 44, $42\frac{3}{4}$, 40, and $38\frac{1}{2}$ inches. In examples where both horns have been preserved, the length of the front one in one case is $37\frac{3}{8}$ and that of the hinder $17\frac{7}{8}$ inches, while in another these dimensions are 33 and 13 inches. At the time when these rhinoceroses were abundant it was the ambition of every South African chief to possess a long staff, or *kerrie*, made from a front horn; and it is, therefore, as Mr. H. A. Bryden suggests, highly probable that the largest dimensions recorded above may have been considerably exceeded.

Distribution. The range of this rhinoceros was always limited, and apparently never extended north of the Zambesi; this restricted distribution being, as already mentioned, largely due to the creature's grass-eating habits. For the last seventy or eighty years it has been unknown to the south of the Orange River, but, according to Mr. Bryden, there is a tradition that it formerly roamed over the greater part of the Cape Colony. About the middle of the present century, when Gordon Cumming, and afterwards Andersson, made their well-known hunting-tours, Burchell's rhinoceros was comparatively common in parts of the Kalahari Desert, Ngamiland, and various districts between the Orange and Zambesi Rivers. Indeed, Gordon Cumming states that on one occasion he saw upwards of twelve of these magnificent animals together in long grass, while Andersson and Chapman speak of having shot as many as eight in a single night, while they were drinking at a water-hole during the dry season. Mr. Selous remarks, however, that the numbers thus met with were probably drawn together from over a large tract of country, as at such times drinking-places are few and far between. In 1874 Mr. Selous met with a considerable number of these rhinoceroses on the Chobi, but on again visiting the same district in 1877 he only came across traces of two, while in 1879 they had completely disappeared. In North Mashonaland there were, however, still a considerable number between 1878 and 1880, while others were to be met with in a small tract on the Sabi River in South-East Africa. About ten years ago Mr. Selous was, however, only able to find a single specimen in Mashonaland, and it was then thought that this animal, which fell to his rifle, was actually the last of its race. In a remote corner of Mashonaland this indefatigable hunter found, however, some half-dozen individuals still living in 1892, two of which were subsequently shot by Mr. R. T. Coryndon. In the north Kalahari Desert the species had been completely exterminated some years previously to 1890.

The extirpation of this rhinoceros is the more to be regretted since our museums are very badly off for specimens. It is, however, fortunate that Mr. Coryndon has succeeded in bringing home the skeletons and skins of two adult examples, which are preserved in the British Museum and the Rothschild Museum at Tring: while there is also a stuffed specimen in the Museum at Leyden. In addition to a magnificent skull, with horns, the British Museum likewise possesses a fine series of detached horns.

Habits. In treating of the common African rhinoceros, we have already had occasion to refer to the exclusively grass-eating habits of this

species, and the consequent restriction of its habitat to open grassy plains. We have also alluded to its habit of walking with its head carried close to the ground; and likewise to the circumstance that the calf always precedes its mother when walking. It may be added that the mother appears to direct the course of her offspring with her long front horn. As regards its time of feeding and taking repose, the animals of this species closely resemble those of the ordinary kind. Mr. Selous states that "their sight is very bad, but they are quick of hearing and their scent is very keen; they are, too, often accompanied by rhinoceros-birds, which, by running about their heads, flapping their wings, and screeching at the



HEAD OF BURCHELL'S RHINOCEROS.—After Sclater.

same time, frequently give them notice of the approach of danger. When disturbed, they go off at a swift trot, which soon leaves all pursuit from a man on foot far behind; but if chased by a horseman they break into a gallop, which they can keep up for some distance. However, although they run very swiftly, when their size and heavy build are considered, they are no match for an average good horse. They are, as a rule, very easy to shoot on horseback, as, if one gallops a little in front of and on one side of them, they will hold their course, and come sailing past, offering a magnificent broadside shot, while under similar circumstances a prehensile-lipped rhinoceros will usually swerve away in such a manner as only to present his hind-quarters for a shot."

These animals were generally found in pairs or in parties of three, although,

as already mentioned, sometimes considerably more were seen together. Although, as we have seen, there is some difference of opinion as to the temper and disposition of the other species, all sportsmen agree that Burchell's rhinoceros was generally a harmless and inoffensive creature. Still, sometimes it would when wounded make a charge; and from the enormous size of the animal such a charge was a serious matter for those against whom it was directed. On one occasion Mr. Oswell caught sight of one of these rhinoceroses, and, putting spurs to his horse, soon came up alongside. He fired with good effect, but the animal, instead of attempting to escape, eyed its adversary for a moment, and then deliberately advancing, made a sudden rush at his horse, thrusting the long front horn completely through the animal's body, so that the point of the weapon struck the rider's leg through the flap of the saddle on the other side. Fortunately, Mr. Oswell was so little injured, that he was enabled to disengage himself from the body of his dead horse, and kill his formidable opponent.

When shot through the heart or both lungs this rhinoceros, like the other species, Mr. Selous tells us, is quickly killed. If, however, the bullet penetrates but one lung, they will go on for miles, although blood may be streaming from their mouth and nose. Similarly, they will hold on their course, at first at a gallop and then at a trot, with a broken shoulder, for more than a mile; but a broken hind-leg brings them immediately to a stop. The latter circumstance is somewhat at variance with Sir S. Baker's account of hunting the common rhinoceros in the Sudan, referred to on p. 478.

Burchell's rhinoceros differed from the other African species in that during the autumn and winter months, that is to say from March till August, it accumulated an enormous quantity of fat; and at such times its flesh is stated to have been of excellent quality, somewhat resembling beef, but with a peculiar and characteristic flavour of its own. The favourite dish was the hump on the withers, which was cut out and cooked with the skin on in a hole in the ground. The flesh of the calf was excellent at any season, and has been compared to very tender veal.

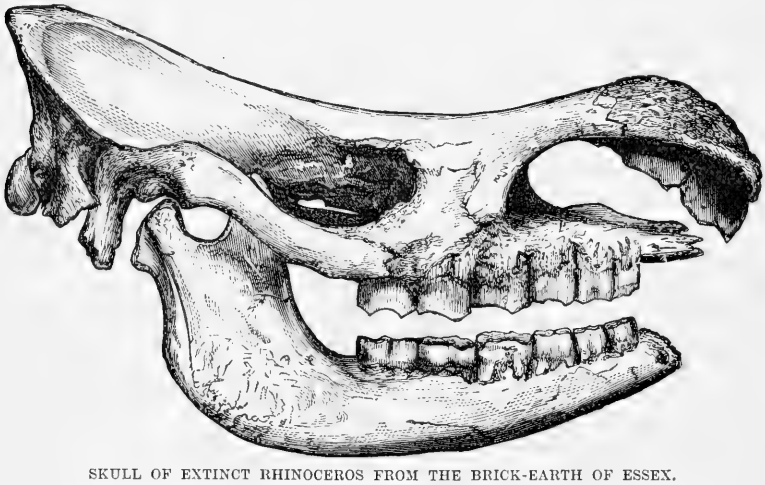
Holmwood's Rhinoceros. Certain very remarkable front horns of a rhinoceros obtained from traders at Zanzibar, and doubtless belonging to an East African form, may possibly indicate a third species, which may be known as Holmwood's rhinoceros. These horns, one of which measures 42 inches, are characterised by their great length and slenderness, coupled with the small size of the base. It has been suggested that they are abnormal horns of the female of the common species, but it is quite probable that they belong to a totally different animal, which may be more nearly allied to Burchell's rhinoceros.

Extinct Rhinoceroses.

In the course of the preceding paragraphs, some reference has been made to certain extinct species of rhinoceroses which approximate closely to some of the existing members of the group. Besides these, there are, however, a multitude of extinct species, which ranged not only over Europe and Asia, but likewise North America. It has, indeed, been suggested that America was the original home of

these animals, from whence they migrated to Asia and Europe; but it appears to us that the evidence is equally in favour of the migration having been in the opposite direction. These rhinoceroses occur throughout the Tertiary period as far down as the upper Eocene division; and even at that low horizon many of the species may be referred to the living genus, although in most cases they were unprovided with horns, while some of them had four toes to each fore-foot. Rhinoceroses are, therefore, even more ancient animals than tapirs.

Mention has already been made of a rhinoceros from Greece, which was closely allied to the common living African species; but there were also several other extinct Old World kinds resembling the existing African rhinoceroses in the presence of two horns and in the absence of front teeth, while in some cases there is evidence to prove that their skins were of the smooth type. One of the most remarkable of these species is the broad-nosed rhinoceros (*R. platyrhinus*) from the Siwalik Hills at the foot of the Himalaya, which was an enormous animal, with upper molar teeth resembling in structure those of Burchell's rhinoceros, although the last one was of the ordinary triangular shape. The other species, with molar teeth of similar type, is the woolly rhinoceros (*R. antiquitatis*), so called from the thick coat of woolly hair with which its body was covered. Skeletons, bones, and teeth of this species have been found in the cavern and other superficial deposits of the greater part of Europe, including England, while entire carcases occur frozen in the ice of the Siberian "tundra." From these frozen specimens it has been ascertained not only that the skin was covered with woolly hair, but likewise that it was devoid of the permanent folds characterising the Asiatic species. The horns of the woolly rhinoceros appear to have rivalled in size those of the living African Burchell's rhinoceros. From the structure of their upper molar teeth it may be inferred that both the broad-nosed and the woolly rhinoceros were grass-eaters. In Siberia, however, portions of needles of conifers and of twigs of other trees have been found in the interstices of the molar teeth of the latter; from which it has been assumed that the animal was a branch-eater. It is, however, quite probable that while in Siberia it may have been compelled from lack of its proper food to take to feeding upon leaves and twigs, yet that in the more southern portion of its range it resembled its allies in being entirely a grass-eater.



SKULL OF EXTINCT RHINOCEROS FROM THE BRICK-EARTH OF ESSEX.

During the Pleistocene period there were three other species of two-horned

rhinoceroses without front teeth, inhabiting England and other parts of Europe, which had upper molar teeth of the general type of those of the common African species, although their skulls were very different. Of these, the Leptorhine rhinoceros (*R. leptorhinus*) and the Megarhine rhinoceros (*R. megarhinus*) are found in the brick-earths of the Thames valley and other superficial deposits; while the Etruscan rhinoceros (*R. etruscus*) occurs in the somewhat older "forest-bed" of the Norfolk coast, and likewise in the upper Pliocene beds of Italy and France. The Leptorhine and Megarhine species have tall-crowned cheek-teeth, and (as shown in the accompanying figure) are characterised by the presence of a vertical bony partition in the skull dividing the two chambers of the cavity of the nose. In this respect they resemble the woolly rhinoceros; a rudiment of the same feature also occurring in the living Javan rhinoceros. The Etruscan rhinoceros, on the other hand, has shorter-crowned cheek-teeth, and no such bony septum in the nasal cavity. That all these three species browsed on leaves and twigs may be pretty confidently asserted from the structure of their upper molar teeth; while a carcase found embedded in the ice of Siberia belonging to either the Leptorhine or the Megarhine species, shows that these had smooth skins like the living rhinoceroses of Africa. The Deccan rhinoceros (*R. deccanensis*) and the Karnul rhinoceros (*R. karnuliensis*), from the superficial deposits of Southern India, indicate that smaller representatives of the two-horned branch-eating group likewise inhabited that country.

Reference has already been made to the occurrence in the Miocene deposits of Europe of an extinct two-horned rhinoceros provided with upper and lower front teeth, which was allied to the living Sumatran species. Throughout the middle Tertiary rocks of Europe, as well as in the Pliocene and Miocene of India, there are found, however, a number of rhinoceroses differing from any living species in the total absence of horns, while in those cases where their limbs are known the fore-feet were provided with four toes. Some of these animals were of very large size, and all of them had molar teeth of the type of that represented in the upper figure on p. 464 (which belongs to one of the Indian species), and their jaws were furnished with large front teeth. Moreover, in one of the Indian representatives of this hornless group, the last molar tooth was of nearly the same form as that in front of it, instead of being triangular. That all these species subsisted on leaves and boughs, may be inferred from the structure of their short-crowned molar teeth; and it may be observed here that all the older Ungulates had short-crowned cheek-teeth, adopted for champing twigs and leaves rather than for masticating grass; whence it may be concluded that grassy plains are probably a comparatively recent feature in the history of our globe. Hornless rhinoceroses also occur in the Tertiary deposits of North America, but at least the majority of these resembled existing types in having but three toes on each fore-foot; while their limbs were relatively shorter than in their Old World allies, and their bodies more elongated. Finally, there were certain other small rhinoceroses from the lower Miocene of both Europe and the United States, in which the front of the skull carried a very small pair of horns placed transversely instead of longitudinally.

The above are all the forms which can be included in the genus *Rhinoceros*.

There are, however, a number of allied extinct animals which connect the true rhinoceroses with more generalised extinct types of Odd-toed Ungulates. Such for instance is the Amynodon, from the Miocene Tertiary of North America, which was a rhinoceros-like animal with no horn, and the full typical number of forty-four teeth. That is to say, there were three incisors, a tusk, and seven cheek-teeth on each side of both jaws; the front teeth being like those of ordinary mammals, and not having the peculiarly modified form presented by those of the true rhinoceroses. Moreover, the whole of the three upper molar teeth were alike; and none of them had the processes projecting into the middle valley which are found in those of all true rhinoceroses. Probably the Amynodon also occurred in the lower Miocene and upper Eocene rocks of France. There were other allied types, but the above example is sufficient to show that the earlier rhinoceroses were far less different from tapirs and some extinct generalised forms to be noticed later on than are their modern representatives.

We must not, however, take leave of the rhinoceros family without referring to a most remarkable creature known as the elasmothere, which flourished during the Pleistocene period in Siberia. This creature was probably as large as Burchell's rhinoceros, and like that species had no teeth in the front of the jaws. The skull had a bony partition in the cavity of the nose, and carried on the forehead an enormous protuberance which, during life, doubtless supported a horn of very large size. The most remarkable feature about the elasmothere is, however, to be found in the structure of its cheek-teeth, which while formed on the type of those of the rhinoceroses, are greatly elongated, and have their enamel so much folded as to present some resemblance to those of the horse. Indeed, the elasmothere may be regarded as a highly-specialised grass-eating creature, presenting a relationship to an ordinary rhinoceros somewhat similar to that which the horse exhibits to certain extinct Ungulates noticed in the sequel.

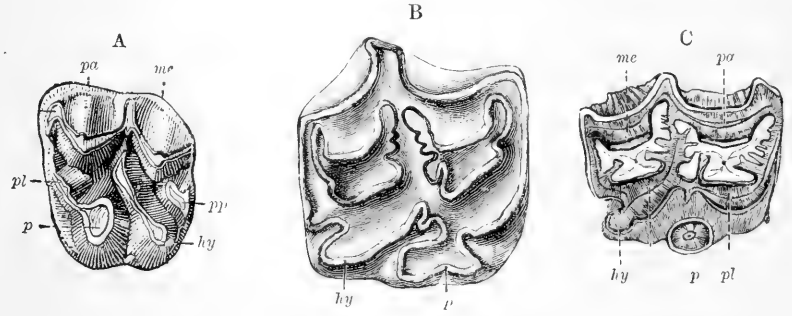
The Horse Tribe.

Family *Equidæ*.

Under the general title of horses, zoologists include not only the animals to which that name is restricted in ordinary language, but likewise the asses, zebras, and quaggas, together with certain nearly-allied extinct animals. All these are characterised by having very high-crowned cheek-teeth, in which the enamel is thrown into a series of complicated foldings, and the deep valleys between the component columns completely filled up with cement. In the upper cheek-teeth, as shown in B and C of the accompanying figure, the outer columns (*pa*, *me*) of each tooth are flattened, and the premolars somewhat exceed the molars in size; while in the lower jaw the ridges are crescent-like, although much complicated by the foldings of the enamel. So different, indeed, are the molars of the horses from those of other Odd-toed Ungulates, that it is at first sight somewhat difficult to realise their fundamental unity of structure. A comparison of the three figures in the accompanying illustration will, however, clearly indicate how the structure of the tall-crowned molar of the horse is essentially the same as that of the low-

crowned molar of the extinct anchithere, while that of the latter does not differ very widely from the molars of the rhinoceros represented on p. 481. Remembering that the figured molar of the anchithere belongs to the opposite side of the jaws to those of the horses, it will be apparent that it would only require a heightening of its columns and ridges, accompanied by the formation of a series of foldings in their investing enamel, and the filling up of the deepened intervening valleys with cement, to produce a very similar type of tooth. It is almost superfluous to add that the tall-crowned molars of the horse, with their completely filled valleys, and their alternating ridges of harder and softer constituents, are far more efficient instruments of mastication than the low-crowned teeth of the anchithere, with their perfectly open valleys. Indeed, while the horse's are adapted for a grinding action, and have nearly flat surfaces, the anchithere's molars are suited to a champing motion, and have ridged surfaces.

Incisors. Another peculiarity in the dentition of the horses is that the incisor or front teeth in both jaws have an infolding of the enamel at the summit of their crowns, as shown in the figures A, B, C, on p. 490.



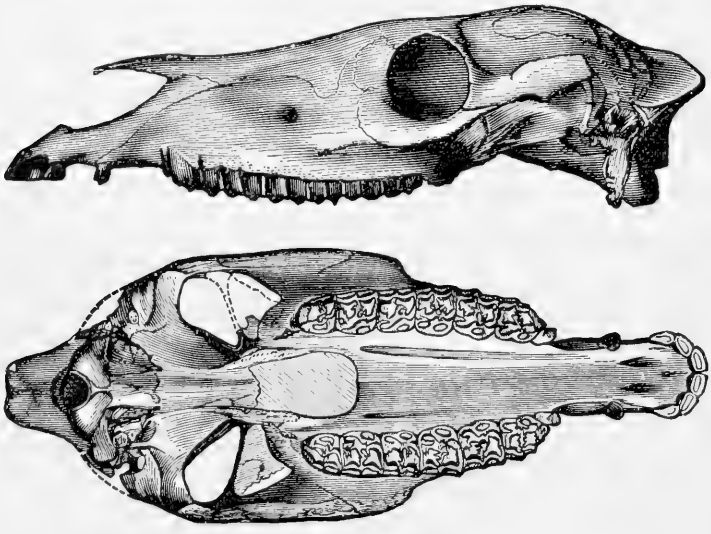
UPPER MOLAR TEETH OF THE ANCHITHERE (A), THE HORSE (B), AND THE HIPPARION (C).
A is from the left, and B and C from the right side of the jaw.

This peculiar structure, of which we shall have more to say in the sequel, may be imitated by taking the finger of a glove and pushing in the top, and afterwards filling the whole of the inside with wax.

Other Characters. The skull of the horses differs from that of all other living Odd-toed Ungulates in having the socket of the eye completely surrounded by bone. In all existing horses the number of toes on each foot is reduced to one, which is enclosed in a large solid hoof. This toe, which corresponds in the fore-limb to the human middle finger, is supported by a single long cannon-bone. On the sides of this cannon-bone there are, however, small splints representing the remnants of the second and fourth toes; and in certain extinct forms (as shown in the figures on p. 153) these lateral toes were complete and furnished with hoofs, although they were much inferior in size to the middle toe, and could have been of little, if any, functional importance. In defining the horse family, it must accordingly be stated that although the toes may vary from one to three in number, it is only the middle one that is functionally important. Another distinctive feature of the family is that in the fore-limb the ulna is represented only by its upper extremity, which becomes united with the radius;

while in the hind-limb the remnant of the fibula becomes similarly fused with the tibia.

Specialisation. So far as their extremely specialised organisation is concerned the horses hold a position among the Odd-toed Ungulates precisely analogous to that occupied by the true Ruminants, or Pecora, in the Even-toed division of the order; and it is curious to observe how the two groups have undergone an almost exactly parallel development, although differing so essentially from one another in the structure of their limbs and teeth. In both, for instance, the cheek-teeth have acquired tall crowns, with complicated foldings of the enamel, and the front teeth are separated by a long gap from those of the cheek-series. Then, again, both have the feet supported by a long cannon-bone, although in the Ruminants this is formed by the fusion of two distinct elements, and in the horses of but one original constituent. Moreover, both groups have the two bones of the lower segment in the fore and hind-limbs fused together, and in both the process by which the second vertebra of the neck articulates with the first has assumed a spout-like form.



SIDE AND PALATAL VIEWS OF SKULL OF EXTINCT THREE-TOED HORSE.—After Zittel.

Equus. The whole of the existing representatives of the horses are included in the genus *Equus*, of which the following are distinctive characteristics. In the upper cheek-teeth the portion called the anterior pillar (marked *p* in the middle figure on p. 487) is connected by a narrow neck of enamel and ivory with the adjacent crescent in the middle of the same side of the tooth; and each foot has but a single toe. The total number of teeth in the males of all the living species is 42; these comprising $\frac{3}{3}$ incisors, $\frac{1}{1}$ canines, and $\frac{7}{6}$ cheek-teeth. The first upper tooth of the cheek-series, that is to say the first premolar, is, however, very small in all the living species, and is frequently wanting, thus reducing the number of teeth to 40. It is, however, larger in many fossil species, and a few of these also have a small first premolar in the lower jaw, thus bringing up the number to the typical 44. The canines of the males are rather small and pointed, and in the females are either rudimentary or wanting. When present, they are placed near to the incisors, but are separated by a long gap from the teeth of the cheek-series.

Form. The horses are such well-known and familiar animals, that it would be superfluous to describe their form and appearance in detail. It may be observed, however, that the ears are long, and that the tail is likewise elongated, but may be either clothed with long hairs throughout its length, or merely tufted at the extremity. The neck carries a mane, which may be either erect or pendent, and the fore-limb has a hard naked callosity above the wrist joint. In most wild species some portions, or the whole, of the body and limbs are

SHIRE STALLION ("MARS VICTOR").—The property of Sir Walter Gilbey, Bart.

marked with transverse dark stripes, but these disappear more or less completely in the domesticated breeds.

Distribution. With the exception of those that have been introduced by man into other regions, horses are now confined to the Old World, and are especially characteristic of Africa. They may be divided into true horses, zebras, and asses.

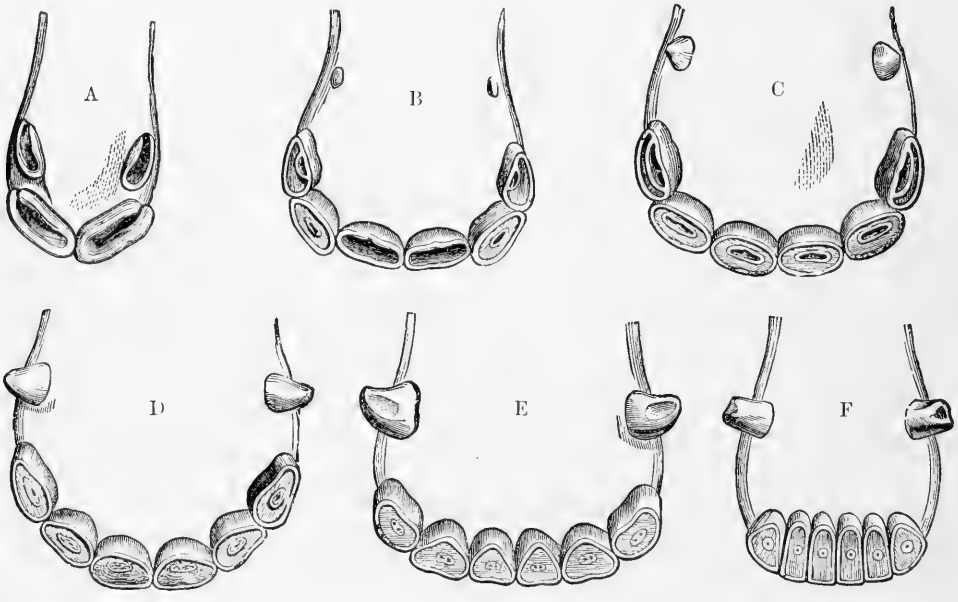
Nomenclature of Limbs. Before, however, proceeding to the consideration of these groups, it may be well to mention that the terms commonly applied to the various segments of the limbs of the members of the horse family are not the same as those used by the zoologist and anatomist. For instance, what is commonly designated the knee of the horse is really its wrist, while the so-called hock in the hind-limb is the ankle-joint. The true knee is, of course, in the hind-limb, and is commonly known as the stifle-joint, while in the fore-limb the elbow-joint is situated, as in other animals, at the lower end of the humerus. The fore and hind cannon-bones respectively correspond to the human middle metacarpal and metatarsal bones, and the so-called pastern and coronet bones to the three joints of the

middle finger and toe; the fetlock being the joint at the lower end of the cannon-bone.

It will thus be evident that the horse is an animal which is supported exclusively by a bone in each fore-foot corresponding to the terminal joint of the human middle finger, and in the hind-foot by the representative of the same joint of the middle toe. In this respect the members of this family differ from all other mammals. Indeed, as is well remarked by Sir W. H. Flower, had we not become so thoroughly accustomed to the horse, we should regard it as a very strange and wonderful animal, as in truth it is.

Indications of Age.

In this place it will be convenient to refer briefly to the changes which take place in the incisor teeth of the horse, with age. As already mentioned, the summits of these incisors are characterised by an infolding



THE UPPER INCISOR AND CANINE TEETH OF THE HORSE AT VARIOUS AGES.
A at 30 days; B at 3 years; C at 6 years; D at 8 years; E at 15 years; F at 30 years.

of the enamel, deeper in those of the upper than in those of the lower jaw, and common to both the milk and the permanent series. When the teeth are first protruded, as in A of the accompanying figure, the whole of the fold is covered with enamel, but when the teeth are worn (as in C) the edges are cut through, and the centre of the crown is occupied by a pit surrounded with a ring of enamel, this being technically known as the "mark." In the figures, A shows the jaw of a very young colt, with only the first and second milk-incisors protruded, both being unworn; the third milk-incisor would appear later. In B, which indicates a horse about three years old, the first permanent incisor has just appeared, after pushing out the corresponding milk-tooth. Between three and a half and four years the second permanent incisor would have likewise appeared, and about half a year later the tusk protrudes from the gum. At five years the third incisor would have displaced its predecessor, and the dentition would then be complete. This state is

shown at C, which represents the jaw of a six-year-old horse, in which the third incisor is partly worn, although still retaining a large mark. Up to five years the age of a horse can consequently be determined with accuracy, and also approximately for some years longer. As a rule, the mark disappears in the first incisor of the lower jaw at six years, in the second at seven, and in the third at eight, while in the corresponding upper teeth it persists about two years longer. D shows the upper jaw of a horse about eight years of age, when the mark has nearly disappeared in the first incisor. After the mark has been lost in all the incisors no indications of age are afforded. In old horses, as in E, a kind of spurious mark is, however, produced, owing to the tooth having become so much worn down that the pulp-cavity of its basal portion is exposed. Such spurious marks have, however, no ring of enamel, and cannot be made to counterfeit the true mark, although attempts to make them pass for this were, and perhaps still are, made by unscrupulous dealers. When the spurious mark makes its appearance, the section of each incisor forms a wide triangle, the broad and flattened crown having been completely worn away; and in extreme old age, when the teeth are ground down to their very roots, as at F, they become very narrow.

The Horse (*Equus caballus*).

The horse differs from the other members of the genus in having the tail thickly covered with long hairs from the root to the extremity, and also by the mane being longer and more flowing. It has also a bare callosity on the inner side of the hind-limb a little below the heel-joint, or hock, so that such callosities are present in all the four limbs. Moreover, the head is smaller, the ears are shorter, the limbs proportionately more elongated, and the hoofs broader than in any of the other species. In colour, domesticated horses vary greatly, but they seldom show any definite markings beyond a more or less distinct dappling. The wild horses of the Asiatic steppes are, however, of a dun colour; and since domesticated dun-coloured individuals—especially in India and Argentina—frequently show a dark streak down the middle of the back, and sometimes two or even three transverse shoulder-stripes, and likewise dark bands on the limbs, it has been inferred that originally the horse was a dun-coloured animal, more or less marked with dark stripes. The height among the domesticated breeds is no less varied than the coloration. Thus, while cart-horses frequently attain the height of 17 or 18 hands (5 feet 8 inches or 6 feet) at the withers, the Shetland pony seldom exceeds 11 hands (3 feet 8 inches), and is occasionally as low as 8½ hands (2 feet 10 inches). The Asiatic wild horses are of medium stature.

From what is known of the present wild or half-wild races, it is probable that the horse was originally an inhabitant of open steppes, where it dwelt in large droves headed by an old stallion. And from the habit displayed by domestic horses of clearing away the snow from their pasture in winter by scraping with the front hoof, Darwin was of opinion that the original habitat of the species was in regions where the ground is covered during a portion of the year with snow.

Distribution. So far as we know at present, the true horse in its original wild state was mainly confined to Europe and Asia, although it extended

eastwards from the latter continent into Alaska. It has, indeed, been stated that certain wild horses found in the Argentine in 1530 could not have been introduced, and must accordingly have been indigenous. Even, however, if this be so (and the story is denied by Dr. Trouessart), there is no evidence to show that the horses in question were identical with *E. caballus*, of which fossil remains appear to be unknown in the New World south of Alaska.

Fossilised remains of horses are extremely common in the brick-earths, cavern-deposits, etc., of England and the Continent, and since these are indistinguishable from the teeth and bones of the existing species, it may be pretty confidently considered they indicate the former existence of that animal in a wild state. And it

ENGLISH RACE-HORSE ("DONCASTER").

may be observed that the researches of Dr. Nehring have afforded reason to believe that during part of the Pleistocene period there existed in Western Europe a condition very similar to that now obtaining in the Russian steppes, where wild horses now live. Further evidence of the identity of these Pleistocene horses with the living species is afforded by certain rude drawings incised on fragments of slate, bone, or antler, which have come down to us from the ancient inhabitants of Europe during the later Stone Implement period. These drawings show that the Pleistocene horse was a rather small, heavily-built animal, with a large head, and a rough mane and tail, in all of which respects it agreed with the under-mentioned tarpan or wild horse of the steppes.

Dr. Nehring is of opinion that the wild horse of Western Europe was domesticated and tamed by the men of the later Stone Implement period at a time when

steppe-like conditions still prevailed in those regions; and there can be but little, if any, doubt that the horses used by the ancient Britons and Germans in the time of Cæsar were derived from the same native stock. It is, however, probable that the existing domesticated horses of Europe have a twofold origin, and that, while the so-called thorough-bred and half-bred races have an Asiatic or perhaps partially North African descent, the breeds denominated by the Germans "cold-blooded" are derived from the primitive European stock.

To how late a date the original wild horses of Western Europe existed as such, cannot now be definitely ascertained. It is true that Strabo relates that wild horses existed in his time in Spain and the Alps, and Pliny speaks of their existence throughout a great part of the north of Europe. The occurrence of these animals in the Ardennes is alluded to by Venantius Fortunatus, and in Italy a reference to them is made by Pope Gregory III. in the year 732. There is also evidence that about the year 1000 the monks of St. Gall were in the habit of using the flesh of wild horses as an article of diet, while so late as 1316 a document alludes to their existence in Westphalia. Moreover, Rösslin, in the year 1593, states that wild horses, which were more shy and difficult to approach than stags, were found in the Vosges, and were captured and tamed by the inhabitants of those districts. In all these cases it is, however, quite probable that these horses were feral rather than truly wild; that is to say, that they were derived from tamed races which had again taken to a wild life. This view is rendered the more probable from the circumstance that, during the historic period the greater part of Western Europe had become a forest-clad region quite different from the open steppes which we have reason to believe were the original home of the horse; but it is not impossible that a certain number of troops of wild horses might have adapted themselves to the changed conditions of their surroundings, and have lived on to the Middle Ages.

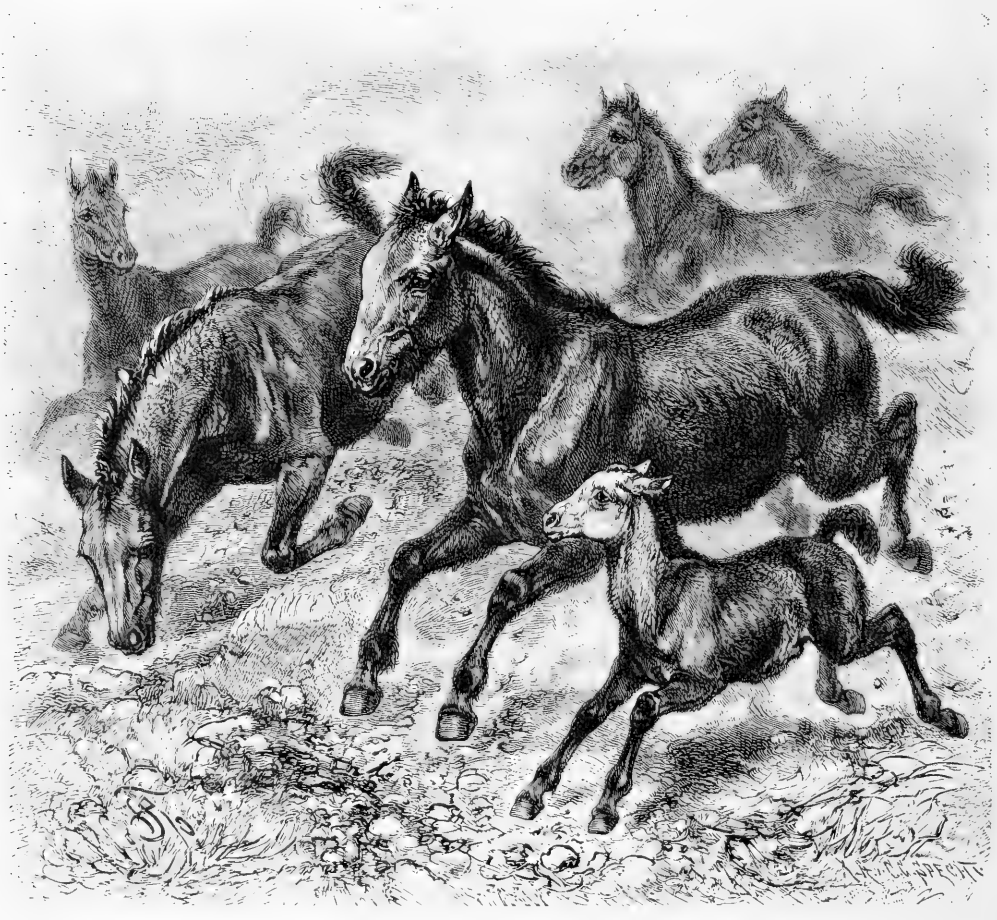
Tarpan.

Although at the present day the tarpan, or wild horse of the steppes, is now confined to Central Asia, there is evidence that in the time of Pallas (*circa* 1760) its range extended westward to the region of the Urals and Volga. This explorer states that at that period the tarpan abounded in the steppes of Tartary and Mongolia, from the Dnieper to the Altai, and thence throughout Central Asia, in small droves seldom exceeding fifty head. The majority are of a reddish grey (dun) or pale grey colour; but from intermixture with individuals which have escaped from captivity, these colours are not invariable. In the pure-bred race, the mane, a streak along the back, and the tail, are reddish brown, while the nose is whitish, and the rest of the muzzle nearly black. They are smaller than the average domestic horse, and have thinner limbs, larger heads, with a convex profile, and longer ears which at their summits are bent backwards in a sickle-like manner. The hoofs are small and cylindrical; and the mane, which extends far on to the forehead and backwards on to the shoulders, is comparatively short, thick, and half-erect. In winter the coat is long, rough, and shaggy: and the bushy tail rather short. Young colts are easily tamed, but the adults are utterly intractable. Tarpan exhibit wonderful speed, and strenuously avoid the neighbourhood of man. They frequent the open steppes, and are never found in forests and mountainous districts.

Since the time of Pallas the tarpan has been steadily driven back to the

more remote parts of Central Asia, where it was met with by Colonel Prejevalski. The troops there are under the leadership of an old stallion, and they always move against the wind, with their ears and nostrils alert to detect the least trace of danger. During the winter the tarpan scrapes away the snow with its front hoofs in order to reach the scanty herbage beneath; and its coat at this season becomes so thick as to form a kind of thin fur.

It has been frequently stated that tarpan are feral rather than truly wild



THE TARPAN ($\frac{1}{25}$ nat. size).

horses. This opinion is, however, vehemently opposed by Dr. Nehring, who believes that in these animals we have the last survivors of the ancient prehistoric wild horses of Europe, which have been more or less modified by an infusion of domesticated blood through the intermixture of individuals escaped from captivity. If Darwin be right in concluding that the primitive horse was more or less striped, it is possible that this infusion of domesticated blood has led to the nearly uniform coloration of the tarpan.

Prejevalski's Horse.

It may be mentioned in this place that a wild horse from Central Asia, described as *E. prejevalskii*, has been regarded as indicating

a distinct species. It is of dun colour, becoming darker on the back, where, however, there is no distinct stripe, and nearly white on the under-parts. Although agreeing in most respects with the horse, it differs by the mane being erect and without a forelock on the forehead, and by the hairs on the tail being confined to the lower half. Sir W. H. Flower suggests that this animal may prove to be a hybrid between the tarpan and the kiang.

Domestication. We have seen that in Europe the horse was probably domesticated during the prehistoric period; and we turn now to the evidence afforded by the Egyptian monuments as to the date of its first use in that ancient country. It appears that no pictorial representations of the animal occur in the frescoes of the so-called old kingdom; and that such are seen for the first time at about the 18th dynasty (1800 or 1900 B.C.), when the reign of the Asiatic Hyksos, or shepherd-kings, who had for so long a period ruled over the valley of the Nile, came to an end. At this period the horse seems to have only been used in war; and it is possible that it may have been introduced by the kings of the 18th dynasty from Syria. Both in Egypt and in Europe it was only at a comparatively late period that the horse replaced the ox as a beast of draught.

In regard to Western Asia, it appears that the horse is of comparatively recent introduction into Arabia, the earliest accounts of the nomads of the Arabian deserts referring only to their possessing camels and asses; while the Arabs in the army of Xerxes are stated to have been mounted on camels. The sculptures of Nineveh show, however, that the war-horse was known at a very early date in Assyria; and it is hence probable that it was from Mesopotamia that the horse was introduced at first to the Syrians on the Mediterranean, and from them to the Egyptians in the valley of the Nile. It is a somewhat curious circumstance that in all the Assyrian sculptures in which mounted warriors armed with the bow are depicted, the horse is invariably led by a second horseman, thus suggesting that at this date the Assyrians were by no means such good riders as the Persians and Parthians subsequently became. The Greeks may have derived their war-horses from the same Asiatic stock; and from Greece and Italy these Asiatic horses probably became intermingled with the native breed originally domesticated in Western Europe. From Mesopotamia the horse probably spread westwards as a domesticated animal into Persia and India, in neither of which countries is there any evidence of the existence of an original wild breed.

In America. Apart from the question whether an indigenous species may have still lingered on in Argentina, at the time of the Spanish conquest horses were unknown in at least the greater part of America. When introduced, from Europe, they soon multiplied, and reverted to a semi-wild condition, and spread over large areas of the country, where they now exist in vast numbers in the open plains. Mr. W. H. Hudson states, however, that in certain parts of Patagonia wild horses are unable to exist owing to the number of pumas; and he suggests that it may have been these animals which led to the practical if not total extinction of the indigenous horses of the New World. In the Falkland Islands the horses introduced by the French in 1764 have become thoroughly wild, and have multiplied to a considerable extent, although not so much so as might have been expected. At the time of Darwin's visit these wild horses were, for

some unknown reason, restricted to the eastern corner of the island; and their comparatively slow rate of increase is attributed to the wandering habits of the stallions, which compel the mares to accompany them, whether or no the foals are able to follow. These Falkland horses have roan and grey for their predominating colours; and in one part of the island are small and pony-like. The late Prof. Moseley was, however, informed that their small stature in this locality was due to the inferior size of the stock from which they are descended. In the peninsula of Lafonia, where the wild horses of the Falklands are of larger size, Prof. Moseley writes that "the strong and active horses each guard their own herd of mares. They keep the closest watch over them, and if one strays at all, drive her back into the herd by kicking her. The younger horses live in herds apart, but the more vigorous ones are always on the look-out to pick up a mare from the herds of the older ones, and drive her off with them, and they sometimes gather a few mares for a short time and hold them, till they are recaptured. When they think they are strong enough, they try the strength of the old horses in battle, and eventually each old horse is beaten by some rival and displaced. The fighting is done mainly with the tusks, and front to front, not with the heels. Thus the most active and strongest males are constantly selected naturally for the continuation of the herds." As in the continent of South America, these wild horses are captured either by the lasso or the bolas. When caught, Moseley states that they "are often broken in by tying them with a raw-hide halter to a post, and leaving them for several days without food or water. After long ineffectual struggles to break loose, the animals become convinced of the absolute power over them of the halter, and in future become cowed and docile directly a halter or lasso is over their heads. The wild horses, when broken in, are very tame and quiet to ride."

ENGLISH RACE-HORSE ("BEND-OR" by "DONCASTER").

The habits of the wild horses of continental South America appear to be very similar to the above. There they are known by the name of cimarrones; and are captured and tamed by the Gauchos, who generally mount them at once and ride them till they are tired out. The Gaucho rides with a loose rein, and his horse's head almost at liberty; and so well are the animals broken, that merely pressing

the part of the reins next to the hand against that side of the neck from which the horse is required to turn is sufficient, without making him feel the bit at all.

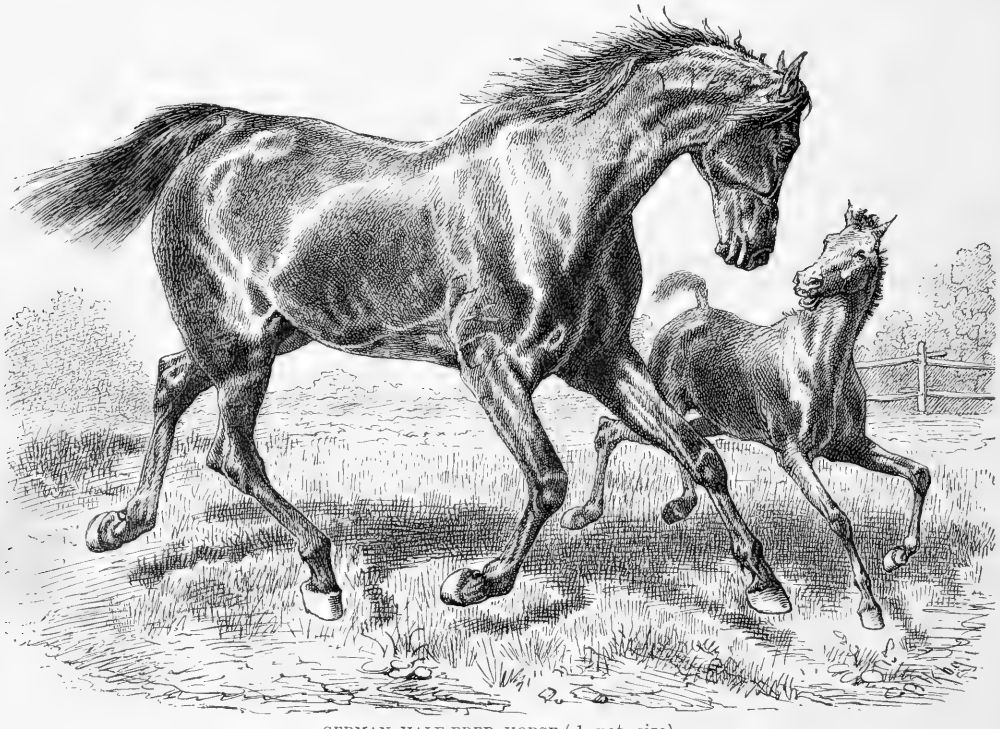
Australia. Feral horses are as abundant in Australia, where they are known as brumbies, as in Southern America. Indeed, so numerous are they in certain districts as to become a positive nuisance to the settlers, by whom they are sometimes shot down in large numbers.

Barbs and Arabs. Proceeding to the consideration of some of the leading breeds of domesticated horses, we may commence with those known as Barbs and Arabs, which have had such an important share in the production of the modern race-horse. With regard to the Barbs, which take their name from their native region, Barbary, it may be premised that the generality of African horses are distinguished from those of Asia by their long limbs and small girth at the loins, thus resembling the foals of other breeds. They display great powers of enduring hunger and thirst; and are fleet, with a high and graceful action. The Barb comes nearest to this general African type, but displays some variation owing to a crossing with other breeds. Low says that these horses "are about 14½ hands high. They are sufficiently deep at the girth, but tucked up in the belly, giving that peculiar greyhound-aspect which is characteristic of this race. Their necks are long and well-formed, their heads moderately fine, the chafron tending to the convex; their shoulders are oblique, and the withers thin and well raised. Their limbs, though thin and delicate, are sinewy; their pasterns are oblique, and the feet well formed. They are gentle and full of spirit; they are somewhat careless in their paces, but distinguished by their graceful action. As compared with the Arabians, they are more swift, but less enduring."

Arab. The Arab horse is strictly a product of the country from which it takes its name; and the breed appears to have been derived from horses introduced into Arabia from the Caucasus or Asia Minor somewhere about the Christian era. They resemble in many respects the horses of these regions, "but," writes Low, "inhabiting a very dry and arid region, their characters have become adapted to these conditions of climate and food. They are more compact than the horses of Barbary, having a rounder body, shorter limbs, with more of sinew, or what is termed bone. Yet they are of the smaller class of horses, very little exceeding, on a medium, 14 hands, or 56 inches in height. As compared with the horses of countries abounding in the grasses, their aspect is lean, their form slender, and their chest narrow. But the slimness of figure of these horses is not inconsistent with muscular force; and their movements are agile, their natural paces swift, and their spirit is unmatched. The power of their delicate limbs is indicated by the well-marked muscles of the fore-arm, and the starting sinews of the leg. The shoulder is sufficiently oblique; the withers are elevated; the back is moderately short; and the quarters are good. The head is well formed; the forehead is broad; the ears are somewhat long, but alert; the eyes full and clear; the veins prominent—the whole rather indicating a happy union of gentleness and spirit, than the fiery temper which is commonly associated with the desert horse." Although not remarkable for great speed, the Arab is pre-eminent for its endurance, hardy constitution, and the scanty fare on which it can exist. On a cold morning in Northern India, when the horses have been picketed round the

camp during the night, the Arabs will be found with their coats as sleek as if they had just come from a warm stable, while those of other breeds will be all awry. In their native home Arab horses will subsist on the scanty herbage found here and there in the desert, and, in the absence of these, on a little barley, chopped straw, dates, and, in extreme cases, camels' milk. They drink only at long intervals, and then but scantily; while their power of making long marches under a scorching sun is unrivalled. The affection with which the Arab treats his horse is too well known to need comment.

Levant and Persian Horses. The horses of the Levant and Persia are more or less closely related to the Arab, but are often of larger size. Indeed, in Southern Persia the horses are very similar to Arabs, though less delicately formed; but in



GERMAN HALF-BRED HORSE ($\frac{1}{25}$ nat. size).

the northern districts they are all larger. The Turkoman horses, which often stand 16 hands in height, are allied to those of Northern Persia.

The English Race-Horse. The English race-horse, of which examples are represented in the figures on pp. 492, 496, has been produced by a gradual improvement of the original native breed, which had been going on for several centuries, and subsequently by a large infusion of Eastern and African blood. The present breed is mainly the product of three foreign horses; of which the first was from the Levant, belonging to Capt. Byerly in 1689, and hence called the "Byerly Turk." From him was descended "Herod," which, as being the most celebrated of this stock, has given the name of the Herod-line to all his descendants. In the reign of Queen Anne the "Darley Arabian" (so called from the name of its owner) like-

wise exerted great influence upon the breed. From him were directly descended "Flying Childers" and "Bartlett's Childers"; while from the latter was derived "Eclipse," the fastest horse which has ever run on the turf. The horses descended from the latter are designated the Eclipse-line. The third horse was the "Godolphin Barb," born about 1724; from whose grandson, "Matchem," is derived the name of the third great line of English race-horses. It should be remembered that both "Herod," "Eclipse," and "Matchem" were closely related to one another; and it is only the descendants of the breed thus produced to which the term "thorough-bred" applies. The form of the race-horse is designed solely for speed, and cannot be taken as a model of equine beauty; the frequent presence of a "ewe-neck" detracting from perfect symmetry. Neither are such horses safe to ride. They have the broad forehead, brilliant eyes, delicate muzzle, expanded nostrils, and wide throat of the Arab and the Barb; while the body is long and light, with the last rib widely separated from the pelvis. The chest is deep but narrow, thus affording due space for the lungs without making the fore-limbs too wide apart. The obliquity of the shoulder gives full play to the upper part of the leg; while the extreme length of the haunch, and the elongated hind-limbs, with their long sloping pasterns, are essentially adapted for the maximum development of speed. The most common colour is bright bay or brown, with black legs, mane, and tail; but chestnut is not unfrequent. Black and grey are rarer; while dun, roan, or piebald but seldom occur.

Hunters, etc. The English hunter has been produced by infusing the blood of the race-horse with the native races to a larger or smaller degree; but it does not form an exclusive breed like the racer. Indeed, any good riding-horse may be a hunter. The requisite qualities of the hunter are strength, good action, and the power of enduring fatigue, coupled with a speed second only to that of the race-horse. The neck must be muscular, and the chest of sufficient breadth to indicate strength without being heavy. The long stride of the racer not being needed, the body should be comparatively short and well "ribbed home," that is to say the last rib should be close to the pelvis. The legs should also be relatively shorter and stouter. In fact, the English hunter may be described as the perfect development of the horse. In Germany the half-bred or three-quarter-bred horse in use as a hunter is commonly known as the *Trakehner*, and is represented in our illustration. From half-bred horses of the hunter type there is a complete transition to the ordinary saddle and carriage-horses, which, although formerly with but little or no foreign blood in them, now generally exhibit more or less breeding. The Cleveland bay is the most highly esteemed English carriage-breed; and has been produced by mingling thorough-bred blood with a native horse of stouter build than the one selected as the stock for the hunter.

Leaping Powers. With regard to the length a horse can leap, "Chandler's" big jump at Warwick in 1847 is still the subject of occasional discussion. The distance was variously measured; and for a number of years was thought to have been 39 feet, but the editor of the sporting paper in which the record was first published afterwards explained that this was a printer's error, and that the distance was in reality 37 feet. This in itself is big enough; so big, in fact, that there are many horsemen in England who will regard it as exaggerated. The portion of the

race in which the jump occurred, is reported as follows in a description of the race in *Bell's Life* of March 28, 1847 :—

This left the lead with "King of the Valley," but he refused at the top of the hill, and soon after "Regalia" caught up with him. They raced together to the brook, with "Chandler" following them. "Chandler's" rider pulled back as they approached it, expecting that "Regalia" would bring grief to somebody, and when they arrived at it sent the spurs into his horse and followed them with all steam on. Both went into the brook, and while they were there "Chandler," who was not able to stop, whatever inclination he may have had to do so, made an extraordinary jump and cleared the brook, horses and riders together. The account goes to say that "Chandler" won the race with ease. The length of the leap was immediately measured, but there was some doubt as to where the animal had landed, as the ground was soft and a number of hoofprints had been made. Captain Broadley, the rider, said that the distance was 37 feet. This beats the record, so far as known, the best previous record being that of "Lottery," who cleared between 33 feet and 34 feet. One of the witnesses of the jump was William Archer, who stated that the distance was 39 feet. The Hon. F. Sawley, a well-known sporting writer in England, was also present, and declared that the tape measured but 34 feet. This is the minimum estimate. Summing up, it may be said that while there is some doubt as to the exact number of feet cleared, "Chandler's" performance was an unusual and important one. The same may be said of a horse called "Proceed," who is said to have cleared 37 feet while running in a steeplechase about the time of the above event. A horse called "Culverthan" is reported to have jumped 33 feet on one occasion, and "Lather," a hunter owned by Lord Ingestre, is said to have jumped 37 feet and 5 inches over a pit. None of these measurements are absolutely authentic. With regard to speed it may be noted that "Flying Childers" ran a distance of 4 miles 1 furlong and 138 yards in seven and a half minutes; but this pace was considerably exceeded by "Eclipse."

American Trotter. The American trotter is an excellent instance of the results obtained by breeding for a particular end; in this case, extreme speed in trotting. The breed appears to have been produced by the infusion of both Barb and Arab blood on an English stock; and the breeders of the United States strongly controvert the common opinion that the trot is not a natural pace of the horse. The maximum recorded pace of the American trotter up to the year 1885 was one mile in 2 minutes $8\frac{3}{4}$ seconds.

Shetland and other Ponies. The Shetland Islands have long been famed for the hardihood and docility of their indigenous ponies, the small size of which has already been mentioned (p. 496). These ponies are allowed to run almost wild, with no shelter, and but little food beyond what they can procure for themselves. Their coats are very long and thick, and in winter become matted upon their bodies in a manner calculated to afford them most efficient protection from the inclemency of the climate. They are generally bay or brown in colour, but sometimes blackish, and at others more or less mixed with white. From their agility and cleverness, these ponies are in great request for equestrian exhibitions. The ponies of Scandinavia and Iceland are very similar to those of Shetland; but those of the Orkneys are larger and coarser, and of less pure breed. In the Hebrides there are

two races of ponies, the one small and long-haired, and the other taller; and there are likewise indigenous breeds in the hilly and forest-districts of several parts of the British mainland. Among the latter may be mentioned the hardy and sure-footed, but coarse and ugly Dartmoor breed; and the smaller long-haired race of Exmoor, which are extremely active, and run nearly wild. The New Forest

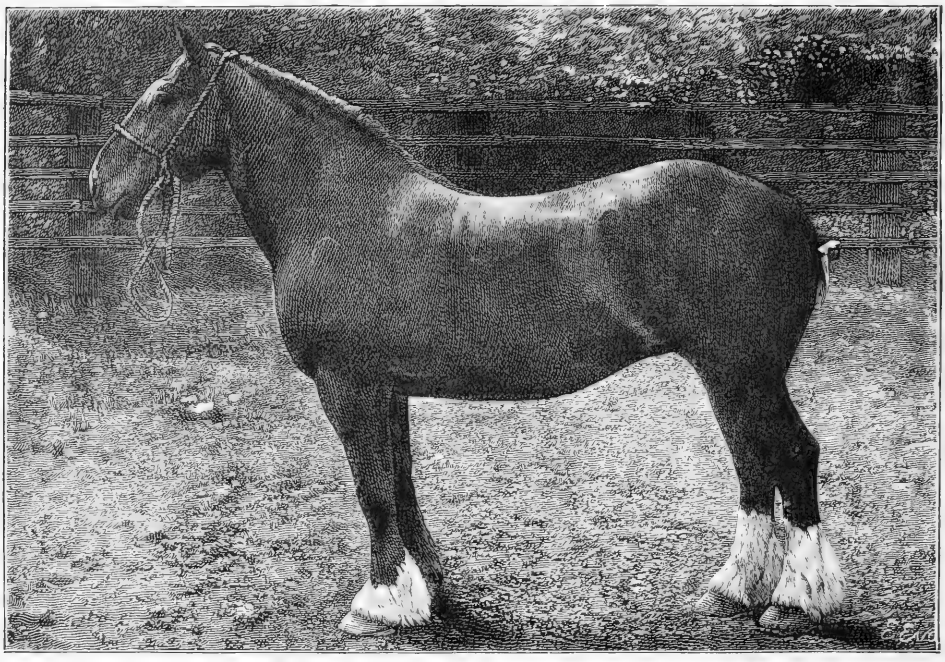
PERCHERON CART-HORSE ($\frac{1}{20}$ nat. size).

ponies, again, form a race which although ugly, large-headed, and short-necked, are hardy, sure-footed, and capable of bearing the roughest treatment.

Cart-Horses. Under the title of cart-horses may be included all the heavily-built European breeds which originally contained no admixture of foreign blood, and are specially adapted for heavy draught. In England there are four chief races, known as the English black or Shire horse, the breeds of the north-eastern counties, the Clydesdale, and the Suffolk punch.

The old English black or Shire horse was characteristic of the fen-districts and some of the other midland counties from whence it has extended north and south,

and it also occurs in the so-called Low Countries and other parts of the Continent. Typically the black horse, as shown in the illustration on p. 489, has a round and massive body, a broad chest, a powerful muscular neck, and short, stout, and long-haired limbs; its physical strength being great, but its speed slight. The size varies considerably; the larger and most powerful races being produced in the fens. The more modern breed generally has a white star on the forehead, and more or less of the same colour on the feet and legs, and often on the muzzle. Low says that "the main defects of his conformation and temperament are his too great bulk of body, and want of action and mettle. For a pull with a heavy



CLYDESDALE MARE ("WOODBINE").—The property of the Marquis of Londonderry.

weight he is admirable; but he steps out short, and is slow in all his motions." Of recent years the aim of breeders has been to remove these defects.

To the north of the Humber the native breeds of cart-horses are of smaller bulk, and generally brown, or still lighter in colour; while they are altogether more active than the black horse. This lighter build appears to be largely due to an infusion of the blood of the higher races among the horses of these districts, which is not wanting even among those employed solely for heavy draught.

Clydesdale. The Clydesdale breed takes its name from the valley of the Clyde in Lanarkshire; and is supposed to have originated by crossing the black horse of the Low Countries with the native breeds. Clydesdales may be either black, brown, bay, or grey in colour, and usually stand about 16 hands, which is considerably less than the height of the black horse. They are also longer in the body and less weighty, with a compact and muscular build, and a characteristic free and long stride.

Suffolk Punch. Lastly, we have the well-known Suffolk punch of East Anglia, famed for its steadiness of draught, and the pertinacity with which it will exert itself against a dead pull. The original breed derived its name from the stout and "punchy" form, and was further distinguished by the colour being light dun or sorrel, sometimes darkening to chestnut, with lighter mane and tail. The height was medium, the pace rather slow, but the power of endurance very great, and the constitution hardy. The form was, however, somewhat ugly, the head being large, with a coarse muzzle, the neck short, and the shoulder low and heavy. On the other hand, the limbs were short, and the back straight, with wide loins and well-developed haunches. The breed, which has of late years been much modified by mixture, is believed to have been introduced from Normandy; and Low is of opinion that its dun or sorrel colour indicates a near affinity with the wild tarpan of the Asiatic steppes.

Foreign Breeds. Among well-known Continental breeds, the percheron, represented on p. 501, while somewhat deficient in bulk and strength, is remarkable for its energy and pluck. Belgium possesses two distinct original breeds known as the Ardennes breed, from the valley of the Meuse, and the Frisian, from the sea-coast. By crossing there has been produced the Brabançon horse, which although inferior in bulk and strength to the Clydesdale, has more breed and energy. Harnessed to heavy country carts, weighing about 3000 lbs., they will drag a load of from 6000 to 10,000 lbs. on the level; and thus vastly exceed in power the original light Ardennes horse, which is fast disappearing.

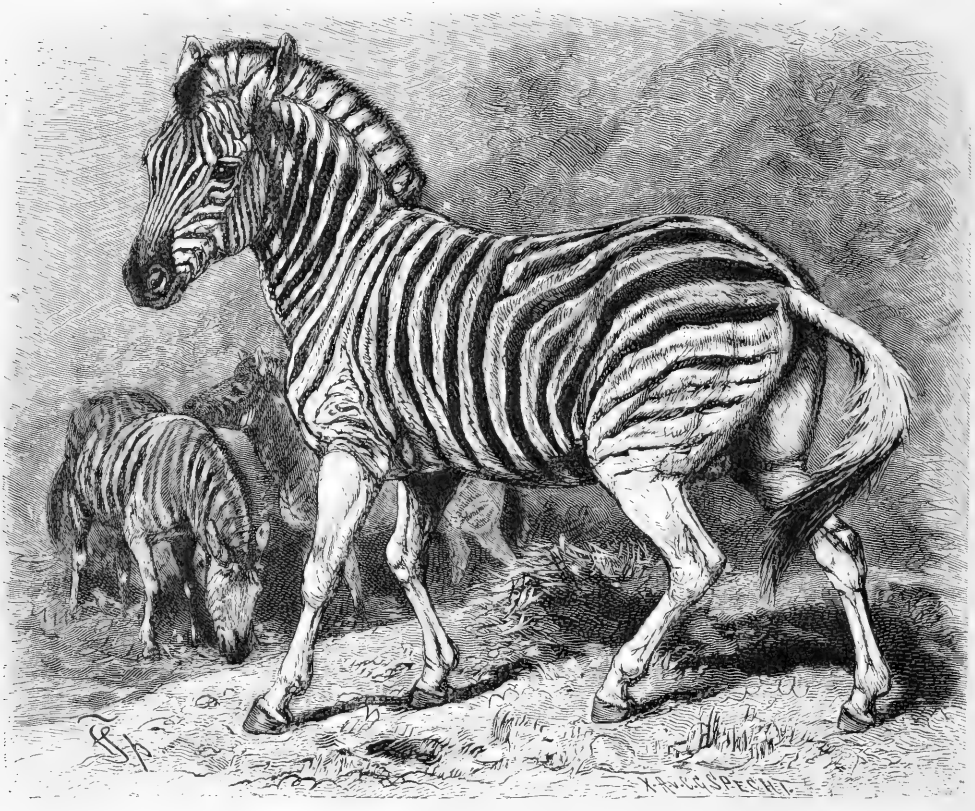
The Zebras (*Equus zebra, etc.*).

The three species of zebra, together with the quagga, form a group agreeing in essential character with the asses, but distinguished by their more or less completely striped heads and bodies. In both these groups the mane is erect, and the upper part of the tail is free from long hairs; while there are naked callosities on the fore-limbs only, and the ears are longer, the head relatively larger, and the hoofs narrower than in the horse.

True Zebra. The true or mountain zebra (*E. zebra*) is the typical representative of the striped group, and is essentially an inhabitant of hilly districts. It is the smallest of the three species, standing from 4 feet to 4 feet 2 inches (12 to 12½ hands) at the withers, and has relatively long ears and a comparatively short mane, with the tail but scantily haired. The general ground-colour of the hair is white, while the stripes are black, and the lower part of the face is bright brown. With the exception of the under-parts of the body and the inner sides of the thighs, the whole of the head, body, and limbs, as well as the upper part of the tail, are striped. On the hind-quarters, the dark longitudinal stripe running down the middle of the back is connected with the uppermost of the oblique longitudinal stripes by a series of transverse bars, which are wanting in the next species; and there may be a longitudinal stripe running up the middle of the chest. This species was originally common in the mountains of the Cape Colony, but has now been exterminated except in some of the districts on the east side. Here a few herds remain on the summits of the Zwartberg,

Sneuwberg, and Winterhock ranges, where they are strictly protected by special laws.

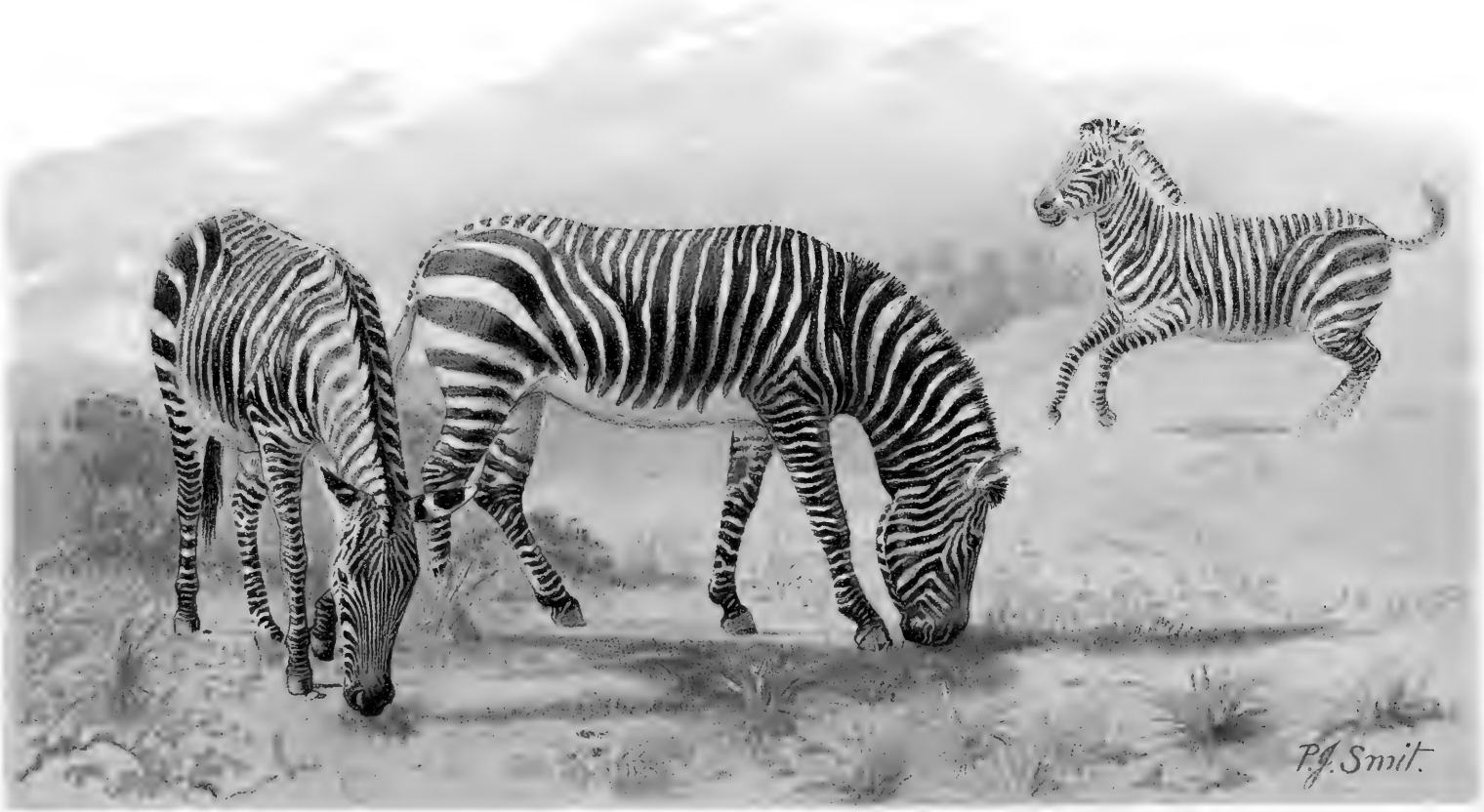
Burchell's Zebra. Burchell's zebra (*E. burchelli*), commonly known by the Boers as the quagga, is a rather stouter and taller animal than the last, standing from 4 feet 4 inches to 4 feet 6 inches (13 to 13½ hands) at the shoulder. It is further distinguished by its shorter ears, longer and more fully-developed mane, and more thickly-haired tail, as well as by the absence of the transverse bars connecting the stripe on the middle of the back with the uppermost of those



BURCHELL'S ZEBRA ($\frac{1}{15}$ nat. size).

on the haunches, and likewise by the union of every alternate body-stripe with its fellow on the middle of the under surface of the body. In the typical form (as represented in our illustration) the tail and legs are quite devoid of stripes, but in the so-called Chapman's zebra, which is only a variety of this species, both may be striped, although the stripes never extend on to the pasterns. The general ground-colour of the hair varies from white to yellowish brown, and the stripes may be dark brown or black. The hoofs are said to be much more like those of a pony than are those of the preceding species.

Distribution and Habits. Burchell's zebra is a plain-dwelling animal, which never appears to have ranged southwards of the Orange River. It now appears to be practically exterminated in the Transvaal, but is still to be met with in numbers



ZEBRA.

in the districts to the south of the Botletli River, to the north of the Kalahari, while in wet seasons a few range further south into the latter district; and it is common on the plains of the Chobi and Zambesi, as well as in East Africa. How far northwards it extends does not appear to be ascertained.

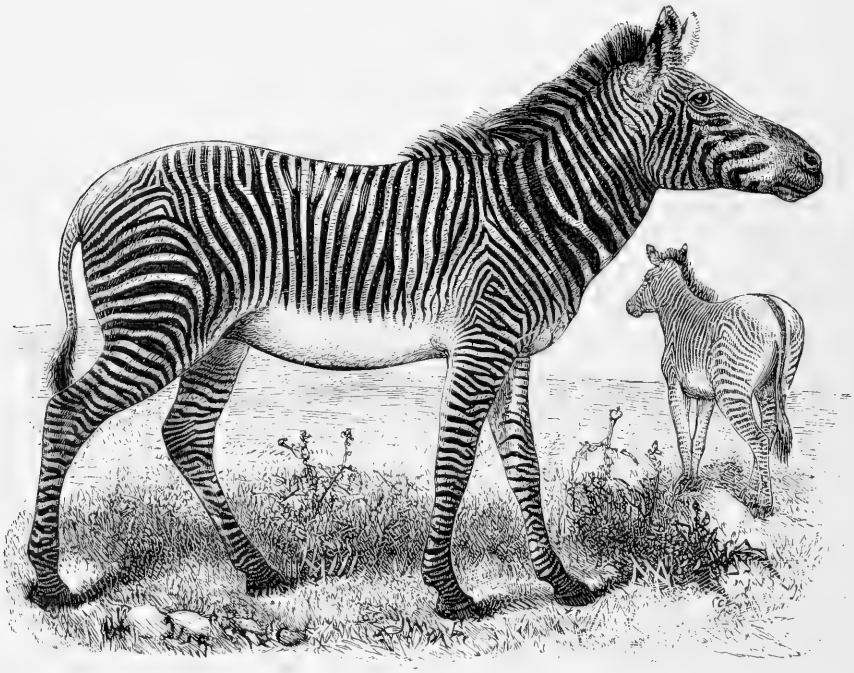
Messrs. Nicolls and Eglington state that zebras of this species "may sometimes be found in herds of from fifty to one hundred, but more often numbering from ten to fifteen, and they are commonly found associating with ostriches, blue wildebeests, and hartebeests. On being hunted, and if not urged too much at the start, they keep generally in single file, the stallions being in front; but when hard pursued they run more in a lump, and at such times it requires a really good horse to overtake them. When one is wounded, it will invariably separate from the remainder of the troop. The neigh of this species resembles in sound the subdued whining bark of a dog. The flesh, although unpalatable to Europeans, is much relished by the natives, on account of its containing a quantity of yellow fat. A large number of these zebras are also slaughtered for the sake of their hides, while others fall a prey to lions, who seem to have a great partiality for horse-flesh." It is this species of zebra which is the one commonly met with in menageries. Many attempts have been made to break it to harness; and, in the Transvaal, teams composed partly of mules and partly of zebras have of late years been worked more or less successfully. Zebras were known to the ancients under the name of hippotigris, and were exhibited from time to time in the Roman circus; such individuals not improbably belonging to the next species.

All who have seen zebras in their native haunts, speak of the beautiful appearance presented by a drove, as they stand for a moment to gaze at the hunter, and then wheel round to seek safety in flight; and as they afford but unsatisfactory trophies, it seems a pity that so many are killed for the mere sake of sport. It has been stated that, when standing on sandy ground in full moonlight, a zebra harmonises so exactly with the colour of its surroundings as to be quite invisible at a short distance.

Grévy's Zebra. The third representative of the group is Grévy's zebra (*E. grevyi*), from the mountains northwards of the Victoria Nyanza, and thence onwards to the highlands of Shoa and Somaliland, which has only been made known to science within the last few years. This species is a taller and slimmer animal than the true zebra, with which, however, it agrees in having the limbs striped right down to the hoofs, in the absence of stripes on the under-parts of the body, and the long ears. On the other hand, it resembles Burchell's zebra in the long mane and abundantly-haired tail. It is distinguished from both by the much greater number of the stripes, which are very narrow, deep black in colour, and separated by equally narrow white streaks. The arrangement of the stripes is, moreover, quite different, those which run transversely across the sides occupying a much greater extent of the body, and the obliquely longitudinal ones on the haunches being proportionately shortened.

Habits. Colonel J. A. Grant, who in company with his fellow-explorer, Speke, first met with these zebras in the mountains north of the Victoria Nyanza, writes that they are found in herds comprising from two to nine individuals. "One of their number, probably the largest male, takes general charge

of the herd; and it was noticed that a large antelope kept watch and gave the alarm on our appearance. They are rarely found outside the forest, preferring it to the open plain, which is generally bare of grass; or they frequent a country with clumps of dense brushwood, or with out-crops of granite, around which they get abundant food; and they were never seen far from running water and hills. Their breeding-season was determined by goats following their mothers in the month of January, and by the shrill calls we heard, which came, I presume, from the goats. The first time I heard their call, I mistook it for that of a bird, and could scarcely be persuaded till I heard the decided donkey-notes following the shriller sounds. They showed much sympathy when a comrade was wounded, lingering with the

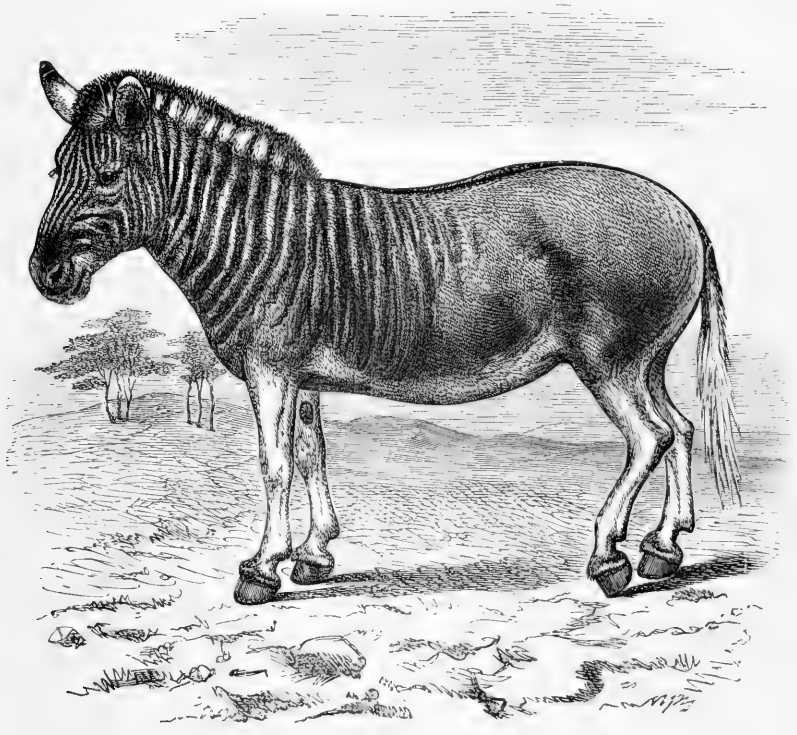


GRÉVY'S ZEBRA. (From Sclater, *Proc. Zool. Soc.*, 1882.)

wounded at the risk of their lives; they mingled with our laden donkeys one day on the marsh." These zebras are found at elevations varying from two hundred up to two or three thousand feet above the sea.

Quagga. The quagga or couagga (*E. quagga*), so far as colour is concerned, forms a connecting link between the zebras and the asses; but in its short ears, and the extent to which the tail is haired, approximates to the horse. In height it stands about the same as the true zebra; in colour the upper parts are of a light reddish brown, with the head, neck, and front half of the body marked with irregular chocolate-brown stripes, gradually becoming fainter, until they are quite lost on the hind-quarters. There is a dark stripe running down the back on to the upper part of the tail; but the rest of the tail, together with the under-parts, the inner sides of the thighs, and the legs, are white.

Distribution. When Sir C. Harris visited the Cape Colony in the year 1839, he described the quagga as existing in immense herds, but it is now, owing to incessant persecution for the sake of its hide, either completely or very nearly exterminated. According to Mr. H. A. Bryden, the quagga always had a very restricted distribution, and, although "formerly so abundant upon the far-spreading 'karroos' of the Cape Colony and the plains of the Orange Free State, appears never to have been met with north of the Vaal River. Its actual habitat may be precisely defined as within Cape Colony, the Orange Free State, and Griqua-



THE QUAGGA.

land West. I do not find that it ever extended to Namaqualand and the Kalahari Desert to the west, or beyond the Kei River, the ancient eastern limit of the Cape Colony to the east."

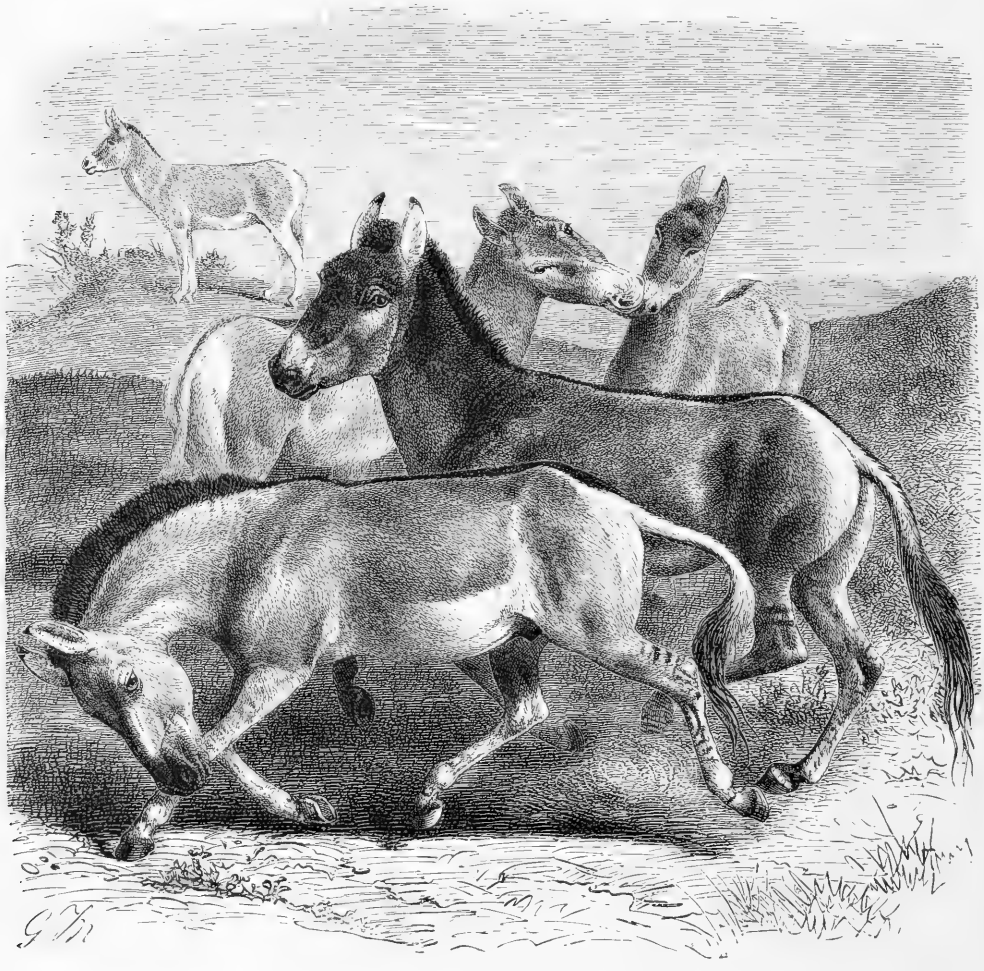
Habits. The name couagga is derived from the shrill bark-like neigh of the animal. In habits this species appears to have been very similar to the other members of this group; and it was formerly much sought after by the Boers in order to supply their native servants with food. It may be added that all the zebras, with the exception of *E. grevyi*, which has not hitherto been exhibited in this country, will interbreed with either the horse or the ass. Indeed, the skeletons of all the living *Equidæ* are so alike that, except from size, it appears impossible to distinguish the teeth or limb-bones of the various species from one another.

The Asses (*Equus hemionus* and *asinus*).

The true asses differ from the zebras in having their bodies without a series of stripes, although there is always a dark streak down the back, and sometimes another across the shoulders, and likewise irregular transverse bars on the limbs.

Asiatic Wild Ass.

Wild asses are widely distributed over the more arid regions of Asia, ranging from Syria to Persia and Western India, and northwards



THE TIBETAN WILD ASS, OR KIANG ($\frac{1}{15}$ nat. size).

over a large extent of Central Asia. It was long considered that there were three distinct species of these animals, but although there are at least two well-marked varieties, Mr. Blanford is of opinion that the whole of these form but a single species (*E. hemionus*). These asses have moderate-sized ears and rather long tails, and stand from 3 feet 8 inches to 4 feet (11 to 12 hands) at the withers. They have a dark brown stripe, sometimes bordered with white, running from the back of the head to the upper portion of the tail, the fore-part of this stripe being formed

only by the mane; the colour of the rest of the upper parts varying from reddish grey to fawn or pale chestnut, while the under-parts are creamy white. In some cases there is a dark shoulder-stripe, while in others the legs are faintly barred with rufous, and the end of the tail is dark.

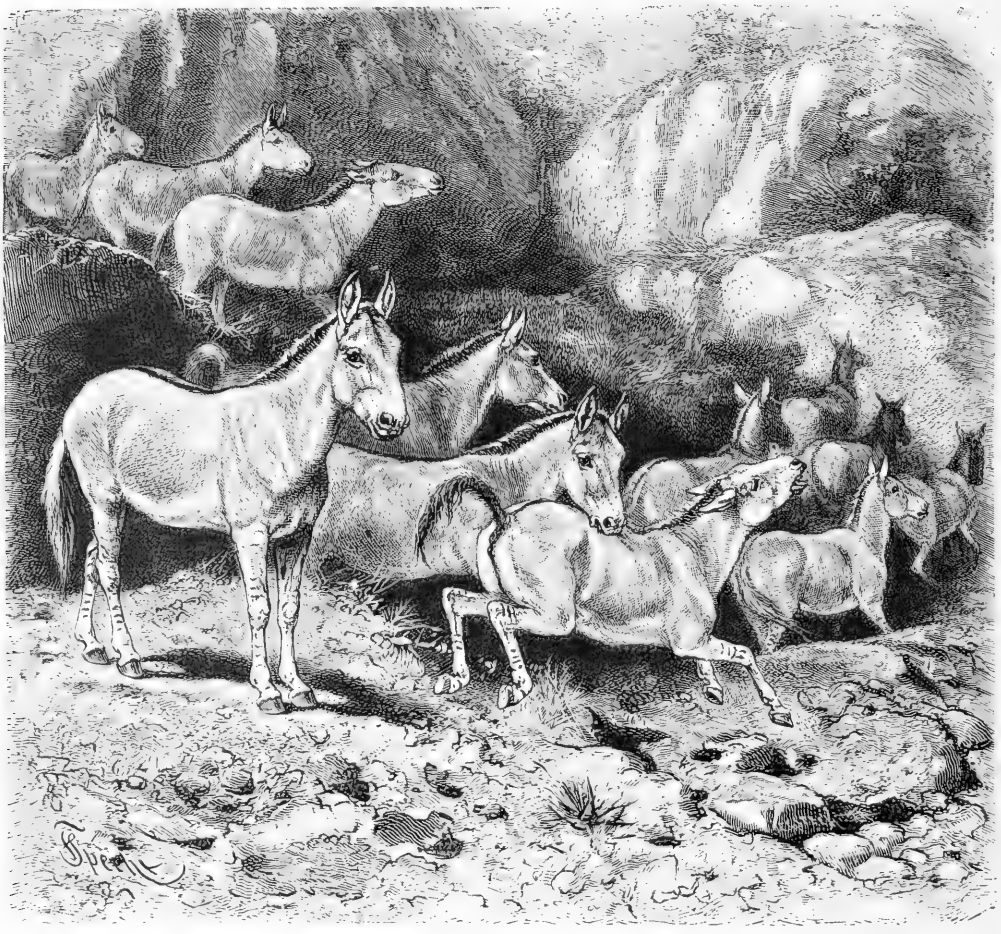
Varieties and Distribution. There are three varieties of Asiatic wild asses, of which the first is the kiang or kulan, of Tibet and Mongolia, characterised by its large size, dark reddish colour, and the narrowness of the stripe down the back. The ghorkhar, or onager, from Western India and Baluchistan, is a smaller and paler-coloured variety, with a broader dorsal stripe, its general colour being sometimes silvery white. Lastly, there is a third variety from Syria and Persia, which apparently differs very slightly from these. In Western Tibet the kiang lives at elevations of fourteen thousand feet and over, while in Cach the ghorkhar is found at the sea-level.

Habits. The Asiatic wild ass is remarkable for its fleetness and its capacity for getting over rough and stony ground at a great pace. As a rule, these animals inhabit desert plains or open rolling table-lands, and are generally found in small parties of from two to four or five individuals, or in herds varying in number from twenty to thirty or forty. In North-Western Afghanistan a herd estimated to contain upwards of one thousand head has, however, been seen in the month of April, and it is stated that the larger herds are composed solely of mares and foals. In the districts to the west of the Indus the foals are born during the summer from June to August; and it is probable that the period of gestation is about eleven months, as with the other members of the genus.

The food of these wild asses consists in the lowlands of different kinds of grasses, which are frequently dry; but in Tibet it is chiefly composed of various woody plants, which form the main vegetation of those arid regions. In the hills to the west of the Indus these animals are to be found wandering pretty well throughout the year; but in the early summer, when the grass and the water in the pools have dried up from the hot winds, the greater number, if not all, of the ghorkhars migrate to the hills for grass and water. It is stated that in Western India and Persia the wild asses are very shy and difficult to approach. This is, however, by no means the case with the kiang of Western Tibet, which is one of the most curious and inquisitive of all animals, frequently approaching within fifty yards or less of any strange object. Indeed, these asses are often a positive nuisance to the sportsman, as they will come up to him as he is engaged in a stalk, and thus alarm and drive away his quarry. In Ladak I have frequently ridden among a herd of kiang, who would gallop close round my pony in circles: and on one occasion a kiang, apparently actuated by extreme curiosity, walked straight into the middle of my camp, where the cooking was going on, much to the alarm of the Indian servants.

The speed of the ghorkhar is so great that it appears to be impossible for a single horseman to ride down an adult in good condition. It is stated, indeed, that this has been done in Cach, but Mr. Blanford is of opinion that in such cases mares in foal were the objects of pursuit. In the Bikanir Desert the foals are captured during the summer by mounted parties of Baluchis, who, by relieving one another, hunt them till they fall from sheer exhaustion, when they are taken and bound.

Such of these foals as can be reared are taken into India and sold to the native princes, by whom high prices are given for these animals. Whether ghorkhars thus taken are capable of being tamed and broken to harness or the saddle, I am not aware; but a kiang which I once saw in captivity in Leh was a most vicious and intractable brute, with which nothing could be done. The late Sir O. B. St. John states that it was told him by the Persians that if the sportsman can manage to conceal himself and his horse in the vicinity of a spring, and wait till the wild

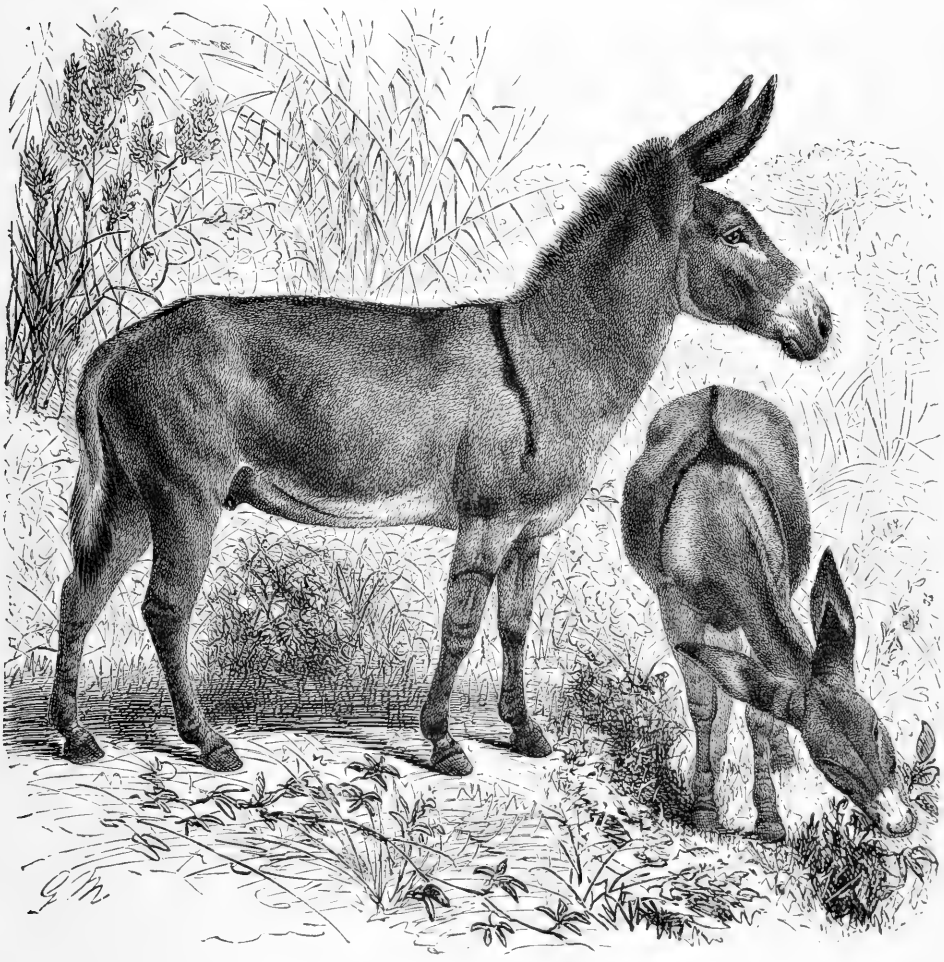


A TROOP OF PERSIAN WILD ASSES.

asses have quenched their thirst, they can readily be come up with when full of water by a short spurt on a fast horse. At other times they are caught by relays of horsemen and greyhounds. It is further stated by the same writer that the flesh of the ghorkhar is only eaten by the Persians when other food is scarce.

There has been some amount of discussion as to the nature of the voice of the kiang, some observers comparing it to that of the common ass, while others think it has more resemblance to the neigh of the horse. The general opinion is, however, that it is decidedly ass-like, and it has been described as a shrieking bray.

African Wild Ass. The African wild ass (*E. asinus*) is a very distinct animal from its Asiatic cousin, having much longer ears, a shorter mane, and the tail more scantily haired. The general colour of the hair is a creamy or bluish grey, without any decided rufous tinge, and there is usually a well-defined dark shoulder-stripe, as well as dark bars on the limbs. The muzzle, a patch under the throat, and the under-parts are white, and there is frequently a large amount of



THE AFRICAN WILD ASS ($\frac{1}{15}$ nat. size).

white on the limbs. There is some amount of individual variation in regard to the relative length of the ears, mane, tail, and limbs: and the degree of development of the shoulder and leg-stripes is also variable, the former being sometimes very narrow and faintly marked, while in other cases the latter markings may be absent. The height may reach 4 feet 8 inches (14 hands) at the withers.

Distribution and Habits. The African wild ass is widely distributed in the desert regions of North-Eastern Africa, occurring in Abyssinia, Somaliland, the Sudan, and other districts in the neighbourhood of the Red Sea. Sir Samuel Baker

says that on the margin of the Atbara Desert "the tracks of wild asses had been frequent, but hitherto I had not seen the animals, as their drinking hour was at night, after which they travelled far into the desert. However, on the morning of the 29th June, shortly after the start at about 6 A.M., we perceived three of these beautiful creatures on our left—an ass, a female, and a foal. They were about half a mile distant when first observed, and upon our approach to within half that distance they halted and faced about. They were evidently on their return to the desert from the river. Those who have seen donkeys in their civilised state have no conception of the beauty of the wild and original animal. Far from the passive and subdued appearance of the English ass, the animal in its native desert is the perfection of activity and courage; there is a high-bred tone in the deportment, a high-actioned step when it trots freely over the rocks and sand, with the speed of a horse. When it gallops freely over the boundless desert, no animal is more difficult to approach, and, although they are frequently captured by the Arabs, those taken are invariably the foals, which are ridden down by fast dromedaries, while the mothers escape." The author then proceeds to notice how admirably the coloration of these animals harmonises with that of their desert surroundings. Their food consists of the wiry herbage found in such regions, but, in spite of such apparently poor diet, these animals are always found in fine condition. The flesh is eaten by the Arabs. It appears that these asses are found either in parties of two or three or in small herds, but that they do not assemble in large troops. Their bray is practically indistinguishable from that of the domestic race.

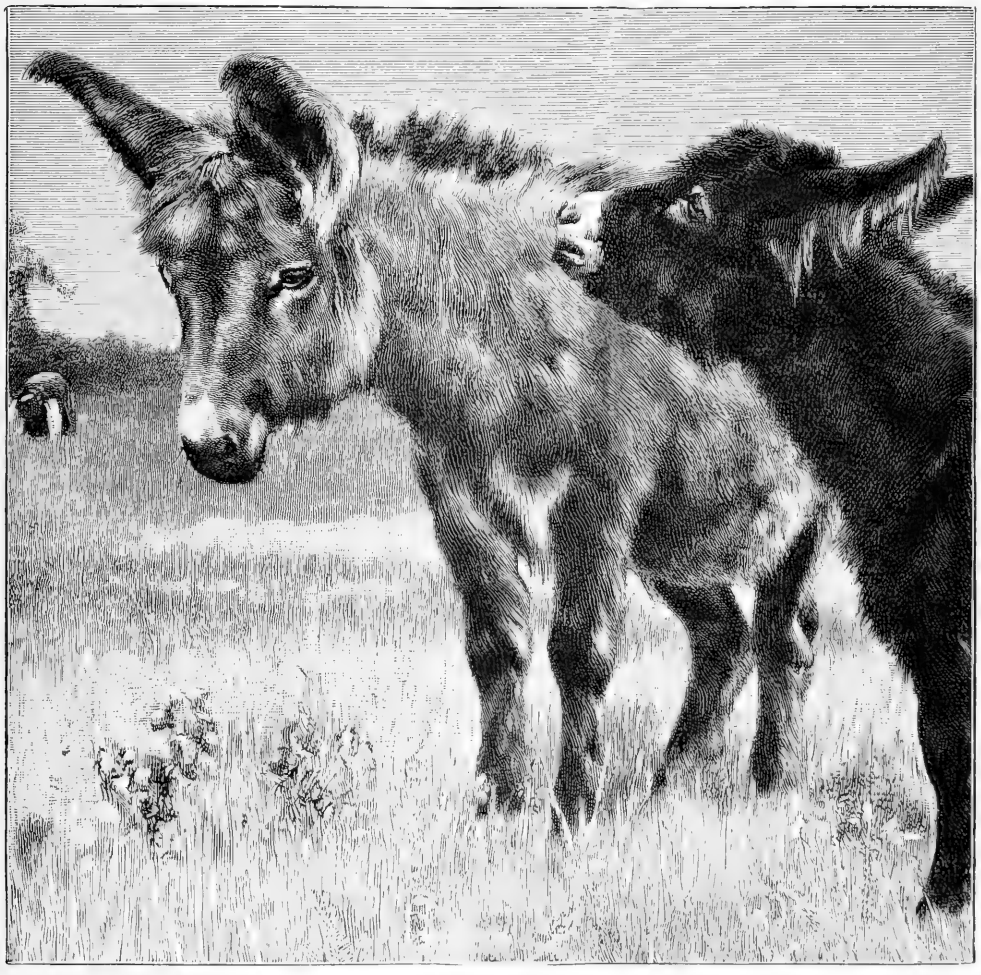
Domestic Ass.

The domestic ass is evidently the tamed African ass, in most cases deteriorated by bad food and hard usage. Any description of such a well-known animal would be superfluous; but it may be observed that, while grey is the ordinary colour, the tint may vary in one direction until it passes into white, while in the other it gradually darkens into a deep brown or even black. The dark stripe running down the back is usually distinct in the lighter-coloured varieties, but the shoulder-stripe is less constant, being frequently absent, although in some instances duplicated. The bars on the legs are generally wanting in the adult, although they are frequently more or less distinctly marked in the foal.

The ass was known to the ancient Egyptians long before the horse, and was, indeed, probably first domesticated in the valley of the Nile, whence it has spread over almost the whole of the habitable regions of the globe. We are not aware, however, of any instances where these animals have reverted to a semi-wild condition. In Europe, the largest and finest breeds are produced in the more southern countries, such as Spain, Italy, and Malta; but there are others of still finer proportions in the United States, where they reach a height of 15 or 16 hands. These larger races are mainly kept for the purposes of mule-breeding, and show that the small size of the ordinary form is due in great part to the rough treatment and bad food which is usually its share. In England the ass was known in the reign of Ethelred, when it fetched the then high price of twelve shillings; but it has been considered that it subsequently became extinct, and was reintroduced about the time of Queen Elizabeth; and it is certain that it did not become common till after the reign of the latter.

The ass is valued not only as a beast of burden and draught, but likewise on

account of its milk; and it is stated that in one district of Equatorial Africa large droves of these animals are kept solely for the sake of their milk. A peculiarity in the disposition of the ass, is its reluctance to cross even the smallest stream of water; this aversion being doubtless a direct inheritance from its desert-haunting wild ancestors.



DOMESTIC ASS.

Mule. The term mule is strictly applicable only to the hybrid between the male ass and the mare; the product of the union of the opposite sexes of these two species being known as the hinny. Mules, although they frequently display the stubbornness and obstinacy of the ass in an intensified degree, are for some purposes more valuable than either of their parents, being very sure-footed and with great powers of endurance. Some of the finest mules are bred in Spain, the United States, and North-Western India, where they frequently attain the height of 16 hands. In Spain they are generally employed to carry burdens, and march in long droves, following in single file a leader distinguished

by a bell. Among the dun-coloured mules of the Punjab, dark stripes on the legs are very common.

There appear to be no authenticated instances of mules breeding among themselves; although the female mule will occasionally produce offspring with the male horse or ass. And it is somewhat remarkable that it does not appear that the hybrids between any other members of the Equine family are mutually fertile.

Fossil Horses.

It has already been mentioned that remains, undistinguishable from the existing horse, occur in the superficial deposits of Europe and Arctic America; but that those found in the corresponding formations of the United States and South America appear to belong to extinct species of the genus *Equus*. In the upper molar teeth of all these species the front inner pillar marked *p* in figure B on p. 487 is much elongated from front to back. In the figured tooth which belongs to an extinct species (*E. sivalensis*) from the Siwalik Hills of India, that pillar is, however, shorter; and in Steno's horse (*E. stenonis*), from the Pliocene deposits of Europe, it is so much shortened as to be almost cylindrical. The same is the case with certain extinct species from the later deposits of the United States and Argentina, which, on account of the great length of the slit for the nose in the skull, are separated as a distinct genus, under the name of *Hippidium*. All the foregoing have but a single toe to each foot, but we now come to certain other species in which there were three distinct hoofs. One of these is the *Protohippus* of the lower Pliocene strata of the United States, in which the upper molar teeth approximate to the one represented in Fig. B on p. 487, but have shorter crowns. The other is the European and Asiatic hipparion, or three-toed horse, of which an upper molar tooth is represented in Fig. C of the page quoted. From that figure it will be seen that the front inner pillar *p* is completely separated from the portion *pl*. That the *Protohippus* was the ancestor of the true extinct horses of America, there can be but little doubt; but, from the separation of the inner pillar of the molars, it is not so certain that the hipparion gave rise to the existing European members of the family.

Other Extinct Odd-Toed Ungulates.

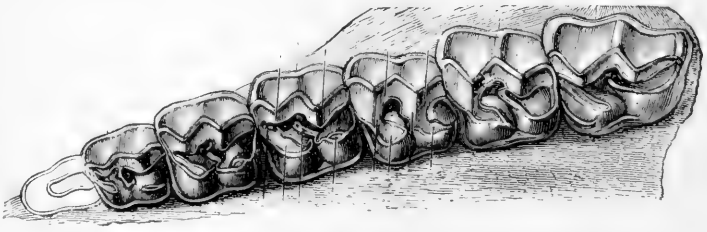
Ancestry of the Horse. The foregoing observations indicate that there is a complete transition from the modern single-toed horse to species with three distinct toes to each foot, and with rather shorter-crowned and simpler molar teeth. From these three-toed horses there is a further gradation to other extinct Ungulates, which cannot be included in the Equine family, but some of which were doubtless the direct progenitors thereof. One of these was the Miocene anchithere, common to both Europe and the United States. From the figures given on p. 487, it will be seen that the upper molar teeth of these animals, although formed on the general plan of those of the horse, have very low crowns, with a simpler arrangement of the pillars and ridges, and the intervening valleys perfectly open, owing to the absence of cement; and it may be added that other species show a complete

transition from the molars of the anchithere to those of the earlier horses. Further, the lateral toes of the anchithere, as shown in the figures on p. 153, were relatively larger than in the three-toed horses. Moreover, in the anchithere, the radius and ulna in the fore, and the tibia and fibula in the hind-limb, were perfectly distinct and fully-developed bones. The largest anchithere approached an ordinary pony in size, while the smallest was not larger than a sheep; and in all these animals there was the full typical number of forty-four teeth, while the "mark" characteristic of the incisors of the horse was but faintly indicated in one species alone. Passing downwards in the geological scale, by a complete transition from the anchithere, we arrive in the lower Eocene London Clay at a small animal known as the hyracothere, which was not larger than a fox, and had four toes to the front, and three to the hind-feet; while the forty-four low-crowned teeth were of still simpler structure than in the anchithere, although formed on the same general plan. The last lower molar tooth of the hyracothere differs however from that of all existing Odd-toed Ungulates in having three complete lobes, and thus approximates to the corresponding tooth of the Even-toed group; and it may be added that the essential correspondence in the structure of the upper molars of the two groups will be apparent by a comparison of the figure of the molar of the anoplothere on p. 421, with that of the anchithere on p. 487.

A step from the hyracothere brings us to the still earlier phenacodus, in which each foot, as shown in the figure on p. 8 of the first volume, had five complete toes; while the molar teeth had their crowns with small isolated tubercles instead of ridges. This small primitive animal, with a most generalised type of structure, appears then to be the undoubted ancestral stock from which the modern horse has been slowly produced by some process of evolution, which was going on throughout the long ages of the whole Tertiary period; and it is at least noteworthy that the true horse only made its appearance on the globe at or about the same time as his master, man.

Palæotheres and Lophiodons.

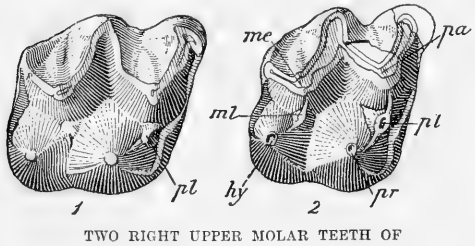
In addition to the animals referred to above, as forming the direct ancestral line of the modern horse, there were a number of other more or less closely-allied types belonging to the Odd-toed group. Among these some of the best and longest known are the palæotheres, from the upper Eocene strata of Europe, of which, as far back as the early portion of the present century, nearly complete skeletons discovered in the gypsum quarries, near Paris, were described by Cuvier. These palæotheres were tapir-like animals, with three toes to each foot, and molar teeth approximating to those of the anchithere in structure, but having a somewhat elongated neck. While some of the species were not taller than a sheep, others must have fully equalled the largest tapirs in size. They probably resembled the tapirs in having a short proboscis to the snout, and



THE LEFT UPPER CHEEK-TEETH OF THE GREAT PALÆOTHERE ($\frac{1}{2}$ nat. size).—After Gaudry.

likewise in their general mode of life. The lophiodons are somewhat older animals, being mainly characteristic of the middle Eocene strata of Europe. Some of them were as large as a rhinoceros; and their upper molar teeth approximate to those of the tapirs having their outer columns conical, instead of assuming the flattened form characteristic of the palæotheres. The lower molars, moreover, differ from those of the palæotheres in having their transverse ridges nearly straight instead of crescent-like; and the total number of teeth is only forty, owing to the loss of the first premolar in each jaw. So far as known, the number of toes to the feet was the same as in the tapirs; and while the true lophiodons apparently indicate a group which died out without leaving any descendants, certain allied forms probably indicate the ancestral stocks of both the tapirs and the rhinoceroses.

Titanotheres and Chalicotheres. In the Miocene period there existed in North America and the Balkans certain gigantic rhinoceros-like Ungulates, which, while belonging to the Odd-toed group, were quite unlike any other forms, and approximated in bulk to the elephants. These titanotheres, as they are called, had skulls somewhat like those of rhinoceroses, but furnished with a pair of bony processes placed transversely in the region of the nose, which were doubtless furnished with horny sheaths during life. The limbs were massive, and furnished with four toes in front, and three behind, one of the fore-feet being figured on p. 152. Some of the species had the full number of forty-four teeth, placed in close apposition to one another; but in others the whole of the lower and one pair of the upper incisors were wanting. The molar teeth are of the type of those shown in the accompanying figure, and differ very markedly from those of other Odd-toed Ungulates; they consist of four columns, of which the outer ones are flattened, and those on the inner side more or less conical. The teeth are further remarkable for the extreme lowness of their crowns. North America also yields remains of smaller but allied Ungulates, such as *Palæosyops*, which extend downwards to the highest beds of the Eocene, and have no bony processes on the skull.



TWO RIGHT UPPER MOLAR TEETH OF PALÆOSYOPS. (From Earle.)

The most extraordinary modification of the Odd-toed Ungulate type is, however, presented by the chalicothere, which is common to the Pliocene and Miocene deposits of Southern Asia, Europe, and the United States. In these animals the molar teeth were of the type of the titanothere; but the limbs terminated in long curved claws, very similar to those of the pangolins or scaly ant-eaters, described in the next volume. Indeed, so like are the limbs of the chalicothere to those of the last-named animals, that they were originally regarded as indicating a member of the same group. Apparently, however, the chalicotheres must be regarded as specially modified Ungulates, more or less closely allied to the Odd-toed group, and adapted for a fossorial, or possibly arboreal mode of life.

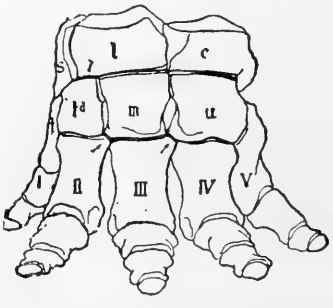
CHAPTER XXVII.

Ungulates,—*concluded.*

Hyraces, Elephants, etc.

With the exception of the extinct phenacodus, noticed among the ancestors of the horse, the whole of the Ungulates described in the seven preceding chapters are characterised by certain peculiarities in the structure of the wrist-joint. On referring to the figure of the fore-foot of the titanothere on p. 152, it will be seen that the bones of the two rows of the wrist are arranged alternately to one another, that is to say, the bone marked *l* is placed immediately over the line of division between the bones *u* and *m*. Moreover, none of these animals have more than four toes to any one foot; while in no case do they walk on the whole sole of the foot after the so-called plantigrade fashion. Then, again, the huckle-bone, or astragalus, in the ankle-joint, is always deeply grooved, as shown in the hind-foot of a deer represented on p. 154, and in that of a rhinoceros on p. 455.

On the other hand, in most of the Ungulates remaining for consideration the component bones of the two rows of the wrist-joint, as shown in the accompanying figure of the fore-foot of an elephant, are placed directly one over the other, so that the line of division between the bones *l* and *c* is continuous with that between *m* and *u*, instead of being placed immediately above *m*. And it will be obvious that this type of structure is inferior from a mechanical point of view to that distinguishing the wrist-joint of the typical Ungulates. The existing and many of the extinct Ungulates described in this chapter frequently have five toes on each foot, and not less than four functional ones, with a rudiment of a fifth on the fore-foot. They may likewise walk partly or entirely in the plantigrade manner; while in the ankle-joint the upper surface of the huckle-bone is generally flat. In all respects, therefore, so far as foot-structure is concerned, these animals are less highly organised than the Ungulates of which we have hitherto treated. The sole living representatives of Ungulates with this generalised type of foot structure are the small hyraces, of which there are numerous kinds, and the two species of elephant. The latter are, however, the last survivors from a number of kindred animals; and there formerly existed several other groups of more or less nearly-allied Ungulates which are now totally extinct. Beyond the generalised structure of their feet, there is but



THE BONES OF THE LEFT FORE-FOOT OF AN ELEPHANT ($\frac{1}{8}$ nat. size). —After Osborn.

little in common between the hyraces and the elephants, which respectively form the representatives of two groups as distinct from one another as is the Odd-toed from the Even-toed group of the typical Ungulates. The elephants have been enabled to survive to the present day by the development of a highly-specialised dentition, and, perhaps, also owing to their huge bodily size; while the small hyraces are sufficiently protected by their habits.

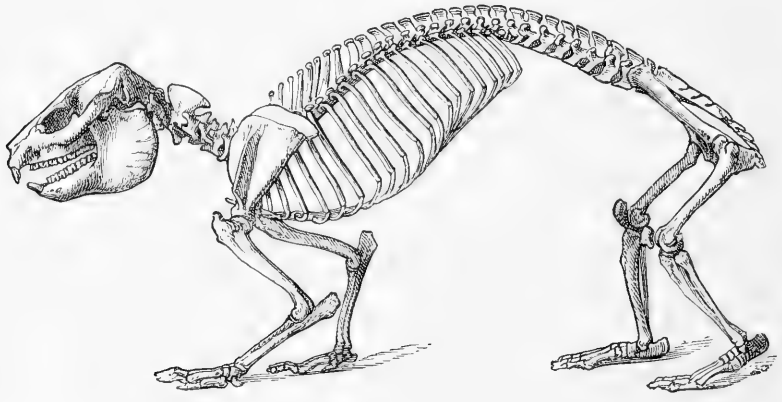
The Hyraces.

Suborder **Hyracoidea.**

Family *Procaviidæ.*

The small animals now generally known as hyraces (from one of their scientific names) are so like Rodents in external appearance and habits, that in our translation of the Bible they are designated by the term coney, which belongs properly to the rabbit.

This Rodent-like appearance is largely due to the circumstance that (as shown in the figure of the skeleton) their jaws are armed in front with long,

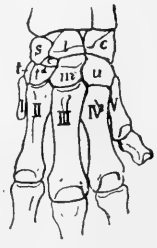


SKELETON OF THE CAPE HYRAX.

curved teeth, adapted for gnawing, and separated by a long gap from the teeth of the cheek-series. Their front teeth are, however, in reality very different, both in form and number, from those of the Rodent mammals. In the upper jaw there are a pair of incisor teeth, of semicircular form, and growing throughout life in the Rodent manner. Instead, however, of being chisel-like, they are triangular in section, and terminate in sharp points, their outer and inner front surfaces being covered with enamel, which is wanting on the hinder surface. In the lower jaw there are two pairs of front teeth, of which the outermost are nearly straight, with long conical crowns divided into three lobes; both pairs of these teeth are, however, rooted, and therefore quite unlike the continually-growing single pair of the Rodents. The cheek-teeth are seven in number on each side of both the upper and lower jaw; and in structure approximate to those of either the rhinoceros or

the palæothere, there being some amount of variation in the form and height of the crowns of these teeth in the different species.

Like other Ungulates, hyraces have no collar-bones (clavicles); and the tail is reduced to a mere stump. In the fore-foot there are four functional toes, of which the outermost is smaller than the others; the first digit being represented by a mere rudiment. The hind-foot has only three toes, of which the innermost is furnished with a long curved claw, while the other two, like all those in the fore-foot, carry broad and short nails, somewhat like those of a rhinoceros. All the bones of the limbs are fully developed and separate from one another; and the thigh-bone, or femur, lacks the distinct third trochanter characterising the Odd-toed Ungulates. In many species the socket of the eye is completely surrounded by bone, but in others it is partially open behind.



THE BONES OF THE UPPER PART OF THE LEFT FORE-FOOT OF THE TREE-HYRAX. (From Osborn.)

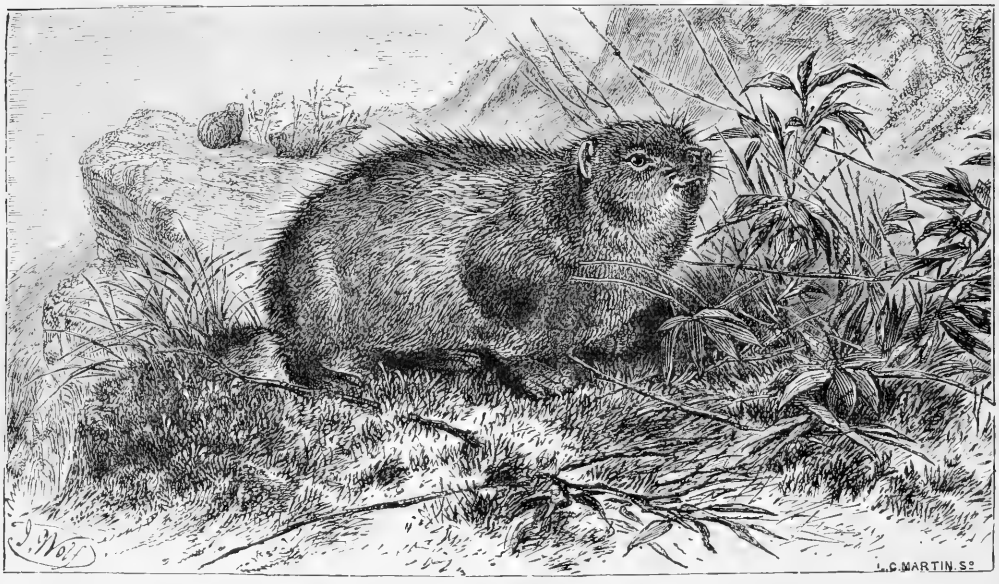
The hyraces have sharply-pointed muzzles and small rounded ears; and their bodies are covered with a thick coat of nearly uniformly-coloured hair, which varies in length in the different species. Near the middle of the back there is a gland, surrounded and partly covered by a patch of hairs differing in colour from those on the rest of the body. Frequently the central part of this gland is naked,—in one species for a length of fully two inches,—but it is generally concealed by the convergence of the surrounding hairs. In most species the female has three pairs of mammæ, one of which is placed near the fore-limbs, while the other two are situated posteriorly; but in three species of tree-hyrax there is but a single pair.

Distribution. The various species of Hyrax, about fourteen in number, are confined to Africa, Arabia, and Syria. In Africa they are found in the extreme south at the Cape, and thence range along the eastern and western coasts about as far north as the 20th parallel of north latitude; while they also occur in the central equatorial regions. They are usually found in rocky districts, at elevations varying from near the sea-level to upwards of eleven thousand feet.

Abyssinian Hyraces. The whole of the species of hyrax are now included by Mr. O. Thomas in the single genus *Procavia*; and as it will be unnecessary to notice all of them, we shall confine our remarks to some of the best known. Of these the Abyssinian hyrax (*P. abyssinica*) agrees with the majority in the light colour of the patch of hairs surrounding the gland on the back. It is of medium size; the total length along the curves of a female specimen measured by Mr. Blanford being 20 inches, and the height at the shoulder 8 inches. Its fur is coarse and harsh, and in specimens from high elevations somewhat elongated, but short in those from the lowlands. The light spot round the gland is very small and inconspicuous.

Habits. Mr. Blanford says "that these hyraces live in rocky or stony places, in communities, like rabbits, haunting holes beneath the rocks. A large pile of loose blocks, especially if there are precipices around, is sure to be inhabited by them. They are frequently found, too, in rocky water-courses. They appear to feed at night and very early in the morning, their principal food being the leaves and young shoots of trees and bushes. During the

day they lie out upon rocks in the shade, or retire, especially towards midday, beneath the rocks. They are timid and wary, rushing into their holes at the smallest intimation of danger. The only sound I heard made by them was a shrill squeak when suddenly alarmed. They can climb over smooth surfaces of rock in a wonderful manner, their large feet aiding them in obtaining a hold." The typical race of this species occurs in the highlands of Abyssinia, the lowland form being of considerably smaller size. Its habits may be taken as characteristic for all the species, with the exception of those frequenting trees. Two other species inhabit Southern Abyssinia, viz. the Shoan hyrax (*P. shoana*), and Bruce's hyrax (*P. brucei*). The former of these inhabits Southern Abyssinia and Shoa, and is nearly or quite the largest of the group; it differs from all others, except the Cape hyrax, in having the spot on the back entirely black, and is distinguished from the



SYRIAN HYRAX.

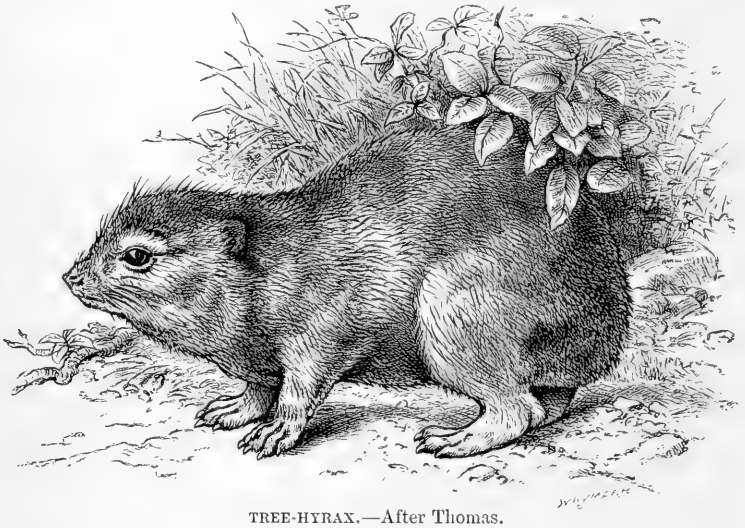
latter by the great length of its soft and silky hair. Bruce's hyrax, which ranges from Southern Abyssinia to Somaliland and Mozambique, is a small and rare species, with the spot on the back long and narrow, and yellowish or whitish in colour. It has been found at elevations of from seven thousand to eight thousand feet.

Cape Hyrax.

The Cape hyrax (*P. capensis*) is confined to the Cape Colony and Natal, where it is known to the Dutch colonists as the klip-das, or rock-badger. It is characterised by the hair being soft and fine, and of medium length, with the spot on the back of an irregular oval form, and black in colour; the general hue of the fur being dark sepia-brown, speckled with pale yellow or white. The late Professor Moseley writes that these animals "come out to feed in the mornings and evenings, but also bask sometimes in the hot sun at midday. They are very inquisitive, and sit up on a rock, and look at one, and then suddenly dash into their hiding-place. After a time, if one remains quiet, they come out for another look, and afford a good chance for a shot. Their cry of alarm is a

short, hissing noise. They had young at the time of our visit [November], and I met with two litters, each of three young, which were about the size of very large rats, with soft chocolate-brown downy hair. The young play about on the rocks together like kittens, chasing one another, and darting in and out among the clefts."

Syrian Hyrax. The Syrian hyrax (*P. syriaca*) is the coney of Scripture, and the only species found out of Africa, its range including Syria, Palestine, the Sinaitic Peninsula, and the whole of Arabia. It is a small or medium-sized and rather variable species, with somewhat soft and shaggy hair of a dull orange-yellow or fawn colour; and the spot on the back rather small, oval, and its component hairs yellow throughout their length. Canon Tristram states that these hyraces produce from three to six young at a birth, but that four appears to be the ordinary number. He observes that "they are far too wary to be taken in traps, and the only chance of securing one is patiently to lie concealed, about sunset or before sunrise, on some overhanging cliff, taking care not to let the shadow be cast below, and thus to wait till the little creatures cautiously peep forth from their holes. . . . They make a nest of dried grass and fur, in which the young are buried like those of a mouse. The flesh is much prized by the Arabs. We found it good, but rather dry and insipid, as dark in colour as that of the hare."



TREE-HYRAX.—After Thomas.

Tree-Hyraces. Three species of the genus, of which one is from Western and two are from Eastern Africa, and not improbably a third from the central equatorial region, differ from the rest in their arboreal habits. These three species agree in that the females have but a single pair of teats; and are respectively known as *P. valida* from Mount Kilima-Njaro, readily distinguished from all the others by the bright fulvous hue of the under-parts, *P. arborea* from Eastern and South-Eastern Africa, and *P. dorsalis* ranging on the west coast from Liberia to the Cameruns and Fernando Po. The latter species is of large size, and characterised by its long shaggy fur, black at the base and white at the tips of the hairs, and the relatively large size of the head compared to the body. The Kilima-Njaro species is found at elevations of from seven thousand to eleven thousand feet in the dense forests clothing the mountain. They live entirely in the trees, making their lairs and breeding-places in holes in the boughs and trunks; and

they are stated to make a great noise at night. A female captured by Mr. H. H. Johnston gave birth to three young. Mr. H. C. V. Hunter states that many of them are captured alive by the natives for the sake of their skins, of which several are sewn together to make cloaks.

It is somewhat remarkable that at present no extinct animals have been discovered which appear allied to the hyraces.

Elephants.

Suborder Proboscidea.

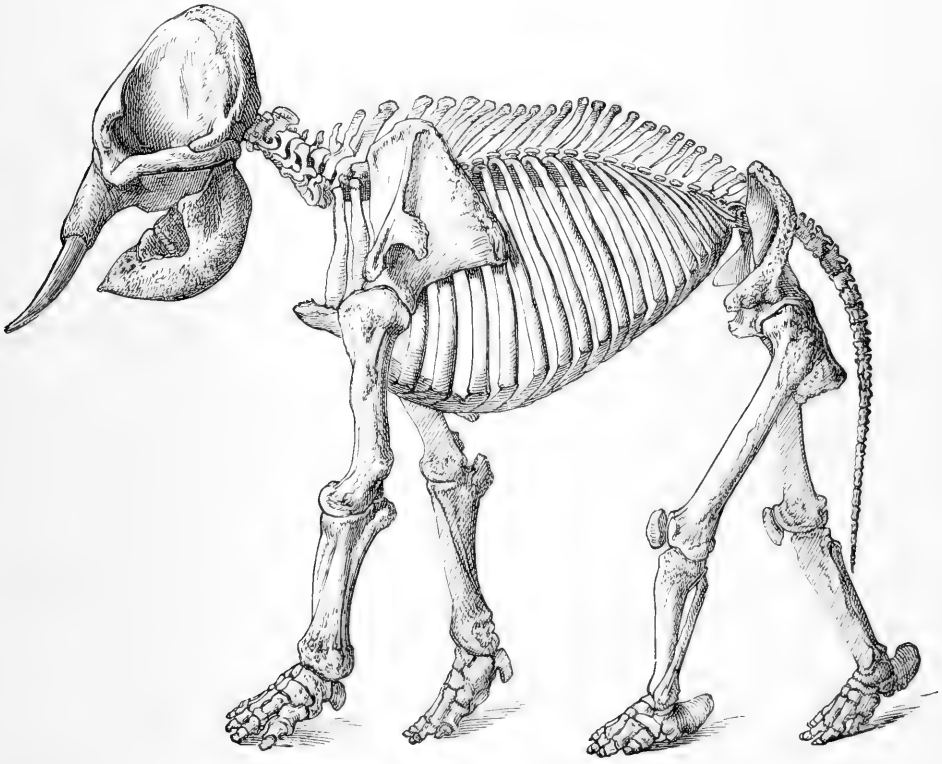
Family *Elephantidæ*.

From their peculiar bodily conformation, their huge size, which exceeds that of all other terrestrial mammals, and the high degree of intelligence which they have been supposed to display, elephants have always excited an amount of popular interest far surpassing that accorded to most other animals. And in truth this deep and widespread interest is by no means misplaced, since elephants really are among the most extraordinary and remarkable forms with which the zoologist is acquainted. Through long experience we are now thoroughly familiarised with their appearance, but if we were to see one for the first time we should probably regard it as the strangest mammal that ever existed; and, indeed, we should not be far wrong in doing so. It has already been mentioned that, so far as regards the structure of their feet, elephants are some of the most generalised of all living mammals; and a similar remark will apply with equal truth to the structure of the rest of their limbs. When, however, we take into consideration the peculiar nature of their dentition, and their marvellously constructed proboscis, we find them possessing characters of the highest specialisation; and it is this combination of generalised and specialised features which render elephants so peculiarly interesting to the zoologist.

At the present day these animals are represented only by the Indian and African species, but in past epochs there were a number of extinct forms, some of which serve to connect the living ones, to a certain limited extent, with other Ungulates; and since it is only by a thorough comprehension of the characters presented by the dentition of these extinct elephants that the structure of the teeth of their living representatives can be understood, it will be necessary in our account of the group to devote almost as much attention to the fossil as to the existing species. It is worthy, however, of note that although some of the extinct elephants do, as already stated, depart less widely from ordinary Ungulates than is the case with the living Indian and African species, yet such approximation to the normal type is only one of degree, and we are at present totally unacquainted with any animals which are absolutely intermediate between elephants and other Ungulates. The origin of the group is, therefore, still totally known, although their nearest relations may prove to be certain extinct groups noticed in the sequel.

Characters. The most striking external peculiarity of elephants, and the one from which their title of proboscidians is derived, is the long, flexible

proboscis, into which the nose is produced; this proboscis having the nostrils at its extremity, and being used as an organ of prehension, and for the purpose of conveying water to the mouth. Their build is extremely massive and bulky, the head being of great proportionate size, the ears large and flapping, the neck very short and thick, and the limbs long and stout. A peculiarity of the limbs, as shown in the figure of the skeleton, is that the humerus in the fore, and the femur in the hind-leg, are very long in proportion to the lower segments; the feet themselves being very short indeed. It will also be noticed that the bones of the limbs are set nearly vertically one above another; and from this cause, together with the



SKELETON OF THE INDIAN ELEPHANT.

great relative length of their upper segments, the knee and elbow-joints are not partially enclosed within the skin covering the body, as is the case in most Ungulates. Consequently, the knee of the elephant is more readily identified with that of man than is the case with that of a horse. It is further owing to this peculiarity in the structure of its limbs that an elephant kneels down, with its fore-feet stretched out in front and the hinder ones behind. The short feet are extremely broad, and have five toes each, of which the middle one (as shown in the figure on p. 517) is the largest; and from the extreme shortness of the feet the ankle-bone is placed close to the ground, instead of being raised half-way up the leg as in the horse. The whole of the toes are enclosed in a common skin, with a flat cushion-like sole; the position of the toes being indicated by the broad flat nails, of which there may

be either three or four in the hind-foot. The fore-foot is broader than the hinder one, and generally has five nails.

In most cases the males, and sometimes the females also, have a pair of tusks in the upper jaw; these tusks corresponding to one of the pairs of incisors of other mammals, and not to the tusks of the wild boar and hippopotamus, which are canines. There are no other front teeth in the upper, and none at all in the lower jaw of the living species. The eyes are small in proportion to the size of the head; the tail is nearly cylindrical, and of considerable length, with a tuft of bristly hairs at the end; but the skin is nearly naked in the two existing species. The female has a single pair of teats placed between the fore-legs.

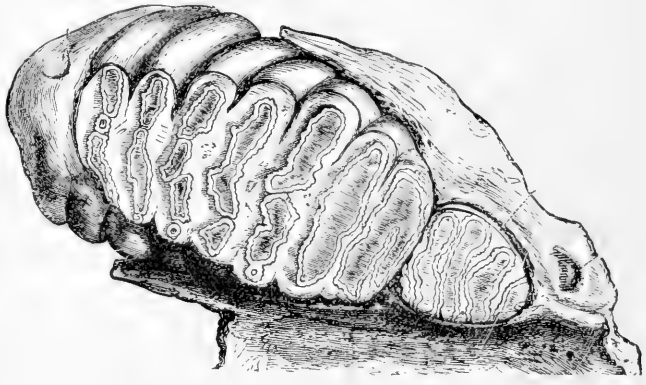
In addition to the proportions and position of the bones of the limbs already referred to, it may be observed in connection with the skeleton that the two bones of the lower segment of each leg are perfectly distinct from one another; and that in the ankle the huckle-bone, or astragalus, is nearly flat both above and below, and is of slight vertical thickness, but of great horizontal extent. The vertebræ of the back have very tall spines for the attachment of the powerful ligaments necessary to support the enormous weight of the head; and the ribs are of great length, and thus afford ample space for the viscera. It will be noticed in the figure of the skeleton that the blade-bone, or scapula, has a backwardly recurved process projecting from its space; and it is remarkable that a nearly similar condition of this acromial process is found in the Rodents.

Skull. From the enormous size of the skull it might be inferred that elephants have very large brains. This, however, is far from the case, the brain not only being very small in proportion to the size of the animal, but likewise of a low degree of organisation. The brain of an elephant occupies indeed only a comparatively small portion of the space lying between the socket of the eye and the region where the vertebræ of the neck articulate with the skull. The whole of the elevated upper portion of the skull is occupied by a mass of bone, honeycombed into cells, and thus affords space for the attachment of the huge muscles of the jaws, and forms an adequate support for the trunk without unduly adding to the weight; the great size of this region being also essential in order to harmonise with the immense development of the lower part of the skull, which has to accommodate the enormous tusks and molar teeth. Similar cells also enter into the structure of the hinder and basal region of the skull. There are many other peculiarities in the conformation of the elephant's skull, but it must suffice to mention here that the nasal aperture is situated high up in the front of the face, and that the nasal bones are reduced to mere triangular nodules, instead of having the elongated form characteristic of most mammals.

Teeth. Of the teeth a more detailed notice is necessary, since these afford some of the most essential characteristics of the group. As already mentioned, elephants have no canine teeth in either jaw; while in the living species the tusks are developed only in the upper jaw. In the young elephant there is a minute pair of milk-tusks, which are shed at a very early age. The permanent tusks, which are nearly cylindrical in section, and taper to their extremities, continue to grow throughout the life of their owners, and thus remain permanently open at their bases, which are enclosed in sheaths of the premaxillary bones extend-

ing as high up in the skull as the aperture of the nasal cavity. In the young state the tusks of the living species of elephants are tipped with enamel; but this is soon rubbed off by use, and they then consist of ivory alone. This ivory differs from that of other mammals in its structure, which renders it easy to distinguish elephant-ivory from all other; and if a transverse section of a tusk be examined, it will be found to present a pattern like the engine-turning on the back of a watch-case; this peculiar pattern being absolutely distinctive of true ivory.

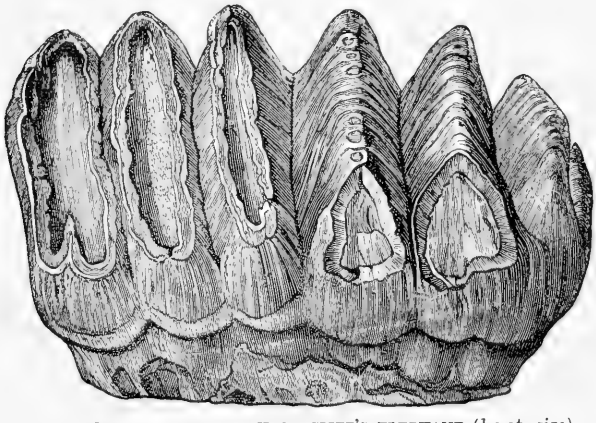
We come now to the consideration of the molar or cheek-teeth of the elephants, which in their structure and mode of succession are unlike those of all other mammals. In the first place, an elephant has six cheek-teeth on each side of both the upper and lower jaws; but instead of all these being in use at once, in the existing species only two are ever above the gums at any one time, and one of these is but partly protruded; while in old animals there is but a single tooth remaining. The molar teeth are elongated from front to back, and are composed of a number of transverse ridges closely packed together. The anterior teeth, as shown in the accompanying figure, are small, and include but few ridges; but each succeeding tooth is larger, and comprises a greater number of ridges, reaching in the last molar of the Indian species to as many as twenty-four. The individual teeth succeed one another from before backwards in an arc of a circle; and as the tooth in front is worn away, its place is gradually taken by the one rising from behind, till at length the sixth and last tooth alone remains. Although this mode of succession appears strange and peculiar, it is in reality only an ultra-development of what takes place among the pigs, and more especially in the African wart-hogs. In all the pigs the last molar does not come into use till the teeth in front of it are considerably worn; and in the wart-hogs, as we have already seen, the last molar is of unusually large size, and may be the only cheek-tooth remaining in the adult condition, owing to those in front being shed. It should be added that while the last three cheek-teeth of the elephants correspond to the true molars of an ordinary mammal, the three anterior ones represent the last three milk-molars of such an animal as the pig, and not, as would at first sight appear to be the case, the premolars. That the three teeth in question are really milk-molars is proved by the circumstance that in some of the extinct species they were vertically succeeded by teeth of simpler structure corresponding to the premolars of the pig.



THE FIRST AND SECOND RIGHT UPPER MOLAR TEETH OF THE MAMMOTH (nat. size).—After Sir R. Owen.

In order to understand the structure of the molar teeth of the elephants, it will be advisable to take those of one of certain extinct species which, like Clift's elephant, exhibit a simpler conformation than those of the existing species. Such

a tooth is represented in the accompanying woodcut, and will be seen to be composed of a number of low roof-like transverse ridges (in this case six), separated by open valleys. When unworn, as on the right side of the figure, such ridges are crowned by a number of small tubercles; but the effect of wear, as shown in the three ridges on the left side of the figure, is to perforate the enamel of which the ridges are externally composed, and thus to reveal an elliptical surface of ivory surrounded by a narrow border of enamel. In the figured tooth the valleys between the ridges are completely open and devoid of cement, but in the teeth of other species of nearly similar type they contain a certain amount of this constituent. Now it only requires that the ridges in a tooth like that of Clift's elephant should be greatly increased in height, with a concomitant diminution of their basal width, which would admit of a greater number being borne in the same length of space, and by the intervening valleys being completely filled with cement, to produce a tooth like that of the Indian elephant. In such a tooth, as shown in the figures on pp. 525 and 528, the ridges have become so tall as to assume the appearance of thin and nearly parallel plates, with their investing enamel thrown into a series of fine plications, or puckers; and the intervening valleys have become so deepened and narrowed, that their contained cement is also in the form of exceedingly thin plates. When worn, as in the figure on p. 528, such a tooth presents on its surface a series of very narrow ellipses of yellow ivory, surrounded by an elevated rim of the harder white enamel, marked by its characteristic puckers; while between the ellipses of enamel-bordered ivory come the layers of cement. The succession of layers in such a tooth is therefore arranged in the following order, viz. cement, enamel, ivory, and so on. The worn crown forms a slightly convex or concave surface, marked by transverse ridges of different degrees of hardness and height, and thus yields a masticating instrument of the greatest power and efficiency.



A LEFT UPPER MOLAR TOOTH OF CLIFT'S ELEPHANT ($\frac{1}{2}$ nat. size).

Habits. In their food, elephants are strictly herbivorous, subsisting chiefly upon roots, twigs, leaves, and young shoots of trees, or grass and other herbage; such food being conveyed to the mouth by the aid of the flexible trunk, which is admirably adapted for such a purpose, as it is for drawing up water. There is, however, much popular misapprehension as to the other uses of the elephant's trunk, in regard to which a few words are expedient. In addition to its use as a purveyor of food and water to the mouth, the trunk is the organ of touch and smell, and is altogether extremely delicate and sensitive. When any danger is impending, elephants, except in some cases when charging an enemy, invariably curl up the trunk out of harm's way. In regard to the alleged

employment of the trunk of the Indian elephant for all manner of purposes, Sanderson observes that "the idea that he can use it for any purpose, from picking up a needle to dragging a piece of ordnance from a bog, is, like many others, founded entirely on imagination. An elephant might manage the former feat, though I doubt it; the latter he would not attempt. Elephants engaged in such work as dragging timber, invariably take the rope between their teeth; they never attempt to pull a heavy weight with the trunk. In carrying a light log, they hold it in the mouth as a dog does a stick, receiving some little assistance in balancing it from the trunk. Tuskers generally use their tusks for this and similar purposes, and are more valuable than females for work. An elephant is powerful enough to extricate a cannon from a difficult situation, but he does it by pushing with his head or feet, or in harness—never by lifting or drawing with his trunk."

Intelligence. An equal degree of misapprehension is prevalent as to the intelligence of elephants, at least so far as the Indian species is concerned; and all competent observers who have had much practical experience of these animals are of opinion that their intellectual faculties have been greatly overrated in popular estimation. It is true, that when in captivity the Indian elephant exhibits a marvellous docility and obedience, and is also capable of learning to perform certain kinds of labour, such as stacking logs of timber, which at first sight appear to demand a considerable amount of intellectual power. There is here, however, a considerable amount of confusion, as Mr. Blanford remarks, between high intelligence and mere docility and capacity for receiving instruction; and there can be little doubt that the usefulness of the elephant is due to the latter rather than to the former trait. Indeed, the size and structure of the brain is quite sufficient to prove that the intellectual capacity of elephants is far inferior to that of dogs, and is probably below that of most other Ungulates.

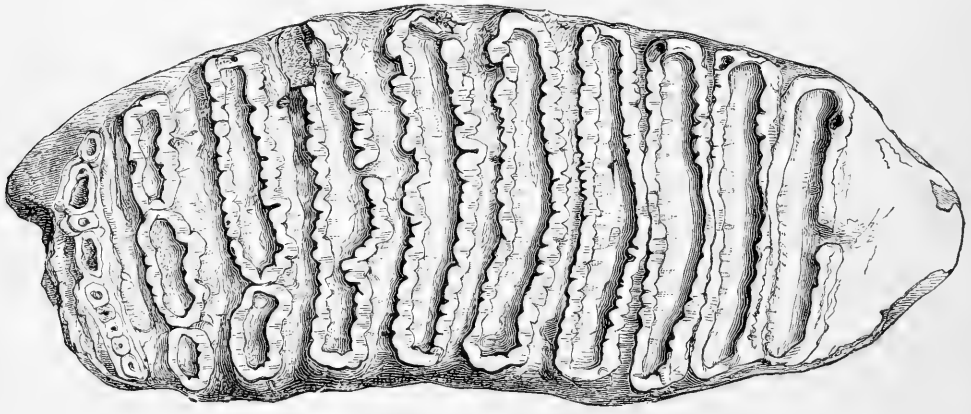
This view of their intelligence is strongly confirmed by the circumstance that elephants, in spite of many statements to the contrary, are wanting in originality, and do not rise to the occasion when confronted by any sudden emergency or event beyond the range of their ordinary daily experience. As Sir Samuel Baker pertinently observes, an elephant "can be educated to perform certain acts, but he would never volunteer his services. There is no elephant that I ever saw who would spontaneously interfere to save his master from drowning or from attack. An enemy might assassinate you at the feet of your favourite elephant, but he would never attempt to interfere in your defence; he would probably run away, or remain impassive, unless guided and instructed by his mahout. This is incontestable; the elephant will do nothing useful unless he is specially ordered to perform a certain work or movement." At the same time, in addition to its capacity for receiving instruction, an elephant undoubtedly appears to have a very retentive memory, both for acts of kindness and of cruelty; and this has doubtless partly contributed to its character for general intelligence.

In this connection it may be observed that the Indian species, at any rate, differs from all other mammals in the readiness with which it may be tamed and domesticated when fully adult; nearly all those which are captured in India being fully mature.

Never found dead. A curious circumstance in connection with these animals is, that the bones of those which have died a natural death are scarcely ever found in the forests of India, and we believe that the same is true with regard to Africa. It has accordingly been suggested that elephants are in the habit of resorting to particular spots when about to die, as is known to be the case with the guanaco in South America (*supra*, p. 415), but as no such mortuaries have ever been discovered in India, this seems scarcely tenable, and the subject accordingly still remains a complete mystery.

The Indian Elephant (*Elephas indicus*).

The Indian, or, as it might be better termed, the Asiatic elephant, is the more specialised of the two living species, and at the same time the one most familiarly known. It is characterised by its comparatively flat forehead, and relatively



A RIGHT UPPER MOLAR TOOTH OF AN ELEPHANT, allied to the existing Indian species ($\frac{3}{4}$ nat. size).

small ears; as well as by the nearly naked skin being smooth, and the tail having a row of long bristly hairs at the tip, and a few inches upwards, before and behind only. The fore-feet have each, as a rule, five nails, and the hinder ones four. Generally the males only have large tusks, those of the females being small and scarcely protruding beyond the jaws. In some males—known in India as mackna, the tusks are, however, not longer than those of females. The back of the Indian elephant is regularly convex, its middle point being higher than the withers.

Perhaps, however, the most important characteristic of this species is to be found in the structure of the molar teeth, which are of the same type as the example represented in the accompanying illustration. In these teeth the plates of enamel-bordered ivory are very thin and closely approximated, and may reach as many as twenty-four in the last of the series. The enamel is thrown into a number of fine puckerings, and each enamel-bordered area forms a greatly elongated and irregular ellipse. In the first tooth (as shown in the figure on p. 525), the number of the ridges is usually four, in the second eight, in the third and fourth about twelve, in the fifth sixteen, while in the last it may, as already mentioned, be as many as twenty-four.

Colour. The general colour of the skin is blackish grey, but there are frequently flesh-coloured mottlings on the forehead, the root of the trunk, and the ears. Occasionally so-called white elephants are met with, which are really albinos; the dark pigment being absent from a larger or smaller area of the skin; in Burma and Siam such albinos being highly valued, and considered as sacred or royal animals. Although, as already mentioned, the skin is nearly naked, it has a few sparsely-scattered hairs; and it has been quite recently discovered that there are faint remnants of a woolly fur, similar to that so fully developed in the extinct mammoth. This discovery is very important, since, taken in connection with the Indian elephant's well-known intolerance of heat, it indicates that the animal is descended from one inhabiting temperate or cold climates.

Dimensions. As in the case of most large animals, the height of the Indian elephant has been greatly exaggerated; but the tendency of recent observers has been rather to depreciate the maximum size which it may occasionally attain. On the average, the height of the adult male does not exceed 9 feet, and that of the female 8 feet; but these dimensions are occasionally considerably exceeded. Sanderson measured a male standing 9 feet 7 inches at the shoulder, and measuring 26 feet 2½ inches from the tip of the trunk to the extremity of the tail; and he records others respectively reaching 9 feet 8 inches and 9 feet 10 inches at the shoulder. An elephant shot by General Kinloch stood upwards of 10 feet 1 inch; and another measured by Sanderson 10 feet 7½ inches. These dimensions are, however, exceeded by a specimen killed by the late Sir Victor Brooke, which is reported to have reached a height of 11 feet; and there is a rumour of a Ceylon elephant of 12 feet. That such giants may occasionally exist is indicated by a skeleton in the Museum at Calcutta, which is believed to have belonged to an individual living between 1856 and 1860 in the neighbourhood of the Rajmehal Hills, in Bengal. As now mounted, this enormous skeleton stands 11 feet 3 inches at the shoulders, but Mr. O. S. Fraser, in a letter to the *Asian* newspaper, states that it is made to stand too low, and that its true height was several inches more. If this be so, there can be no doubt that, when alive, this elephant must have stood fully 12 feet. It may be added that the height of an Indian elephant is almost precisely twice the circumference of its fore-foot.

With regard to the maximum weight of this species, we have no information. An immature male of 8 feet in height weighed, however, 2 tons 17 cwt. 1 qr. and 25 lbs.; while a second, of 7½ feet in height, turned the scale at 2 tons 11 cwt. and 23 lbs.

The tusks of the male vary greatly in length and weight. A pair obtained by Mr. Sanderson measured 5 feet along the curve, with a girth of 16 inches at the point of emergence from the jaw, their weight being 74½ lbs. The single perfect tusk of the elephant referred to above as having been killed by Sir V. Brooke measured 8 feet in length, and nearly 17 inches in circumference, and weighed 90 lbs. This weight is, however, exceeded by a shorter tusk of about 6 feet in length, which reached 100 lbs.; and specimens obtained from the Garo Hills are reported to have respectively weighed 155 and 157 lbs.

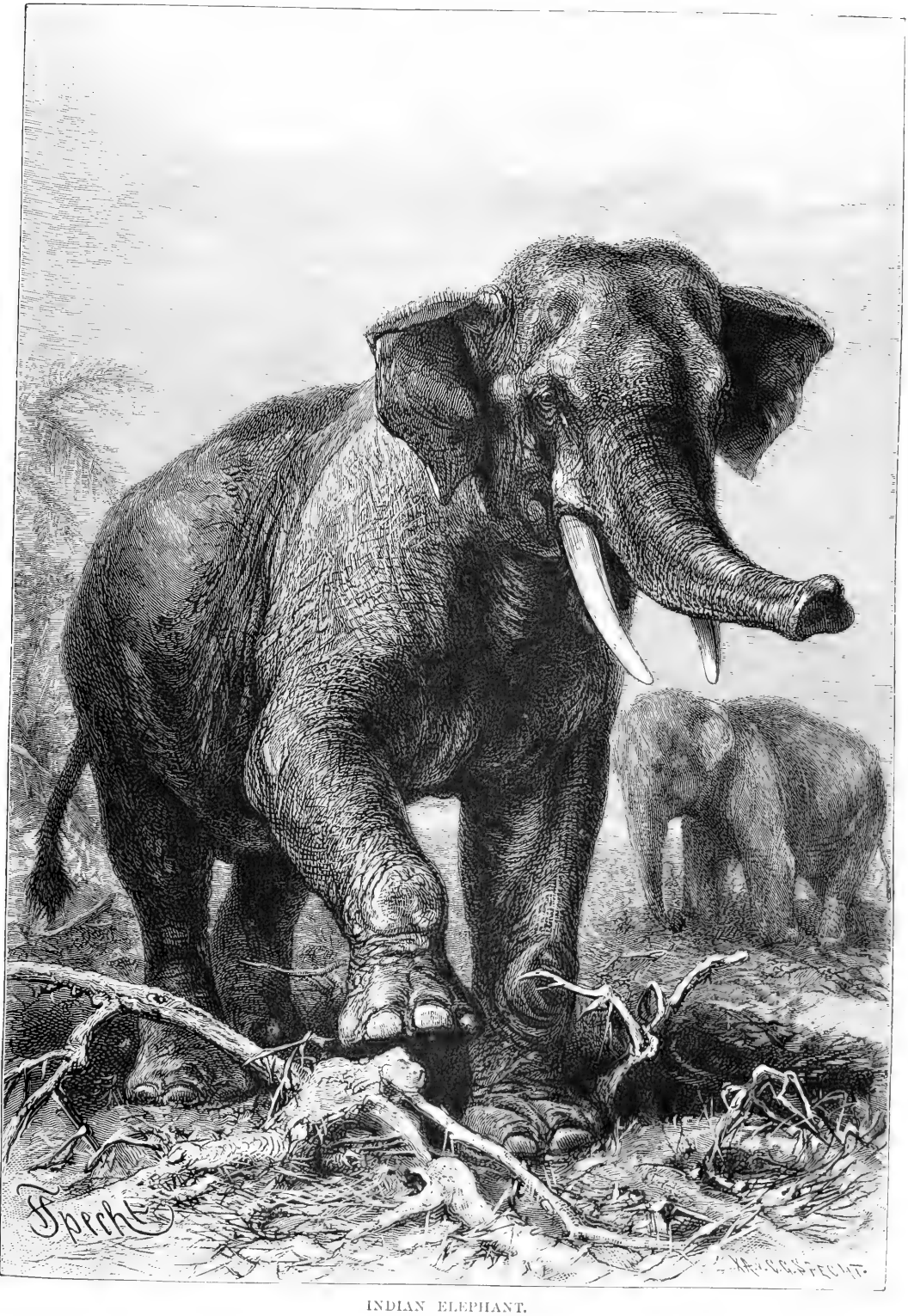
Age. It is of course impossible to obtain any accurate data as to the age which the Indian elephant may attain in its wild state, and we can only, therefore, suggest an approximation to what this may be from captive specimens. Although full grown at the age of twenty-five, an elephant, as determined by the condition of its teeth, is not then mature. A female captured in Coorg in 1805, when about three years of age, did not appear to be particularly old-looking in 1878, although she had then passed her prime. Other individuals have been known to live in captivity for over a century; and since it is obvious that the artificial mode of life which prevails in this state cannot be one tending to promote longevity, it is probable that the estimate of a century and a half as the duration of life in the wild state is not excessive.

Distribution. At the present day the Indian elephant inhabits the forest-regions of India, Ceylon, Assam, Burma, Siam, Cochin-China, Sumatra, and Borneo; although Mr. Blanford is of opinion that its occurrence in the island last named may be due to human agency. According to the same writer, in India elephants "are still found wild along the base of the Himalaya as far west as Deira Dun; also in places in the great forest country between the Ganges and Kistna as far west as Bilaspur and Mandla, in the Western Ghats as far north as 17° or 18°, and in some of the forest-clad ranges of Nagpore and farther south. They do not appear to ascend the Himalayas to any elevation, but are sometimes found at considerable elevations above the sea in Southern India, and in Ceylon they range near Newera Ellia, over seven thousand feet." In former times their distributional area in India was still more extensive.

Habits. For full accounts of the habits of the Indian elephant, both in the wild and domestic state, we are largely indebted to the writings of Sir Emerson Tennent, Mr. G. P. Sanderson, and Sir Samuel Baker. The accounts of the former were, however, largely drawn from native sources, and are therefore, in some respects, less reliable than those of the other two. It is accordingly mainly from the latter that the following summary is compiled.

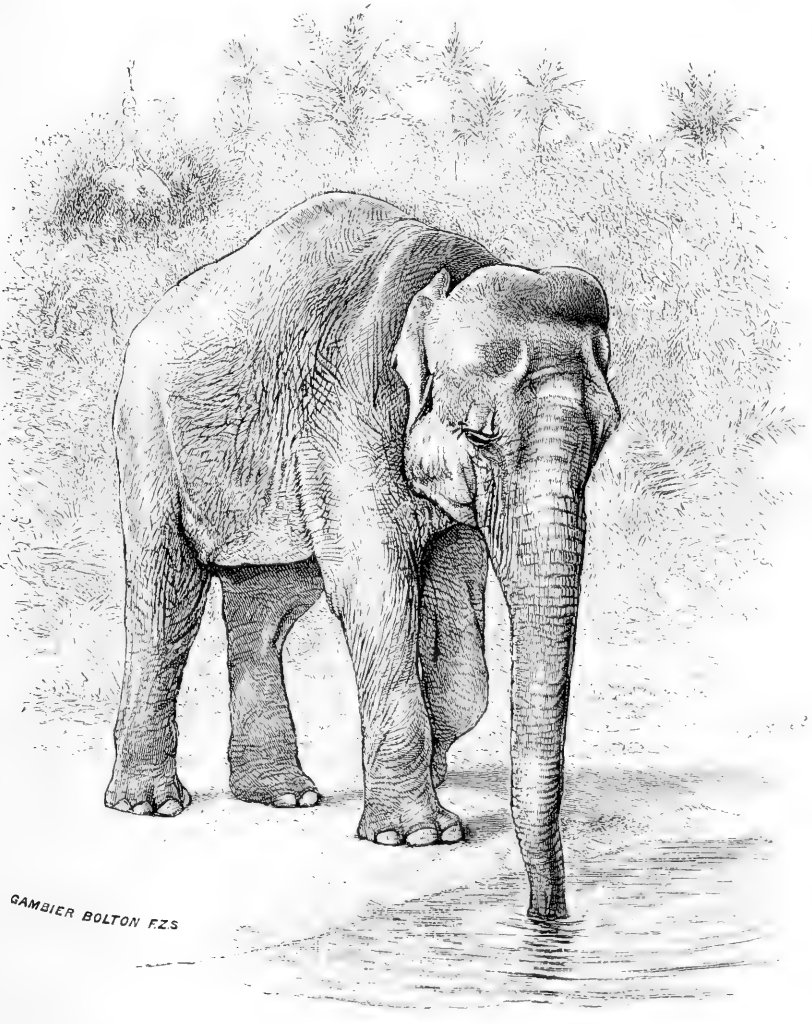
Elephants chiefly frequent districts covered with tall forest, where the ground is undulating or hilly, and where bamboos grow in profusion. During the hot months, in the early part of the year, they keep chiefly to the densest portions of the forest, in the neighbourhood of water; but with the commencement of the rains they venture out into the open glades to feed upon the young succulent grass, and in the late summer in the Madras districts descend at times to the lower jungles. Contrary to general opinion, the Indian elephant is exceedingly intolerant of the burning rays of the sun, to which it never voluntarily exposes itself. As Sir S. Baker observes, "its dark colour and immense surface attract an amount of heat which becomes almost intolerable to the unfortunate creature when forced to carry a heavy load in the hot season in India. Even without a greater weight than its rider, the elephant exhibits signs of distress when marching after 9 A.M." In cloudy and showery weather elephants move about a good deal during the time that they are in the open country; and when travelling from one forest to another they almost invariably march in single file.

Herds of elephants usually consist of from about thirty to fifty individuals, all of which belong, as a rule, to a single family; although females and young males



INDIAN ELEPHANT.

are said occasionally to migrate from their own proper herd to another. In some cases a herd may include as many as a hundred head; but when fodder is scarce all the larger herds break up into smaller parties of from ten to twenty individuals, these smaller parties keeping within a distance of two or three miles of one another,



INDIAN ELEPHANT DRINKING.

and reuniting when conditions are more favourable. A female seems to be invariably the leader of the herd, although in it may be included males of all ages, and on the march the females with their calves occupy the van, while the tusked males bring up the rear. The old bulls are frequently solitary for a time, but generally each belongs to a particular herd, which it visits occasionally. Solitary male elephants are known as "rogues," and are generally characterised by their fierce and quarrelsome disposition: according to Mr. Sanderson, elephants

that are permanently solitary are, however, comparatively rare, the majority of the so-called rogues really belonging to herds. These leave their companions, as a rule, merely for a time, in order to visit the cultivated lands, where the less venturesome females hesitate to follow, and where they inflict enormous damage on the growing crops.

The food of the Indian elephant is mainly composed of grass, leaves, and young shoots of the bamboo, stems, leaves, and fruits of the wild plantain, and the leaves, twigs, and bark of certain trees, more especially figs. The generally succulent nature of its food is in harmony with the structure of the molar teeth, which present a relation to those of the African species almost exactly analogous to that which exists between the molars of Burchell's and the common African rhinoceros. In plucking tussocks of grass or branches of trees, the elephant coils the end of its trunk around them and then tears them off; and the same method is employed in stripping leaves from a bough, or bark from a stem. Small objects such as fruit are, however, picked up by the small finger-like process forming the termination of the trunk above the aperture of the nostrils. When drinking, elephants immerse the end of the trunk in water, which is sucked up to a distance estimated at from 15 to 18 inches in its tubes, and then emptied into the mouth. As a rule, the times of drinking are soon after sunset and shortly before sunrise. Grain is drawn up into the trunk, and then blown out into the mouth.

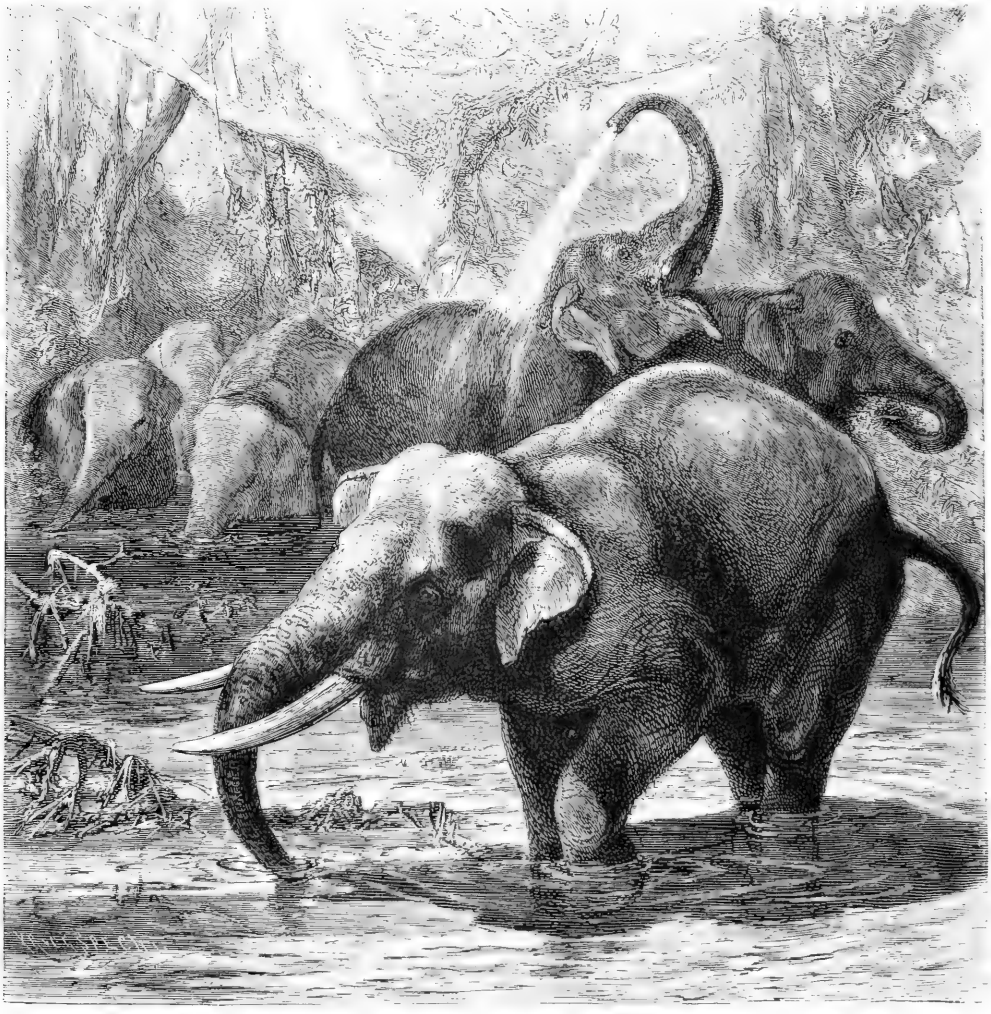
Wild elephants are in the habit of roaming about and feeding both during the day and night, although they usually rest from nine or ten o'clock in the morning till three in the afternoon, and again from eleven at night till three in the morning. When sleeping, they lie down in the usual manner, and although the members of a herd at once scatter in all directions on any sudden alarm while feeding, they quickly reassemble.

When the season of the year is not too cold, elephants are fond of bathing, or rolling themselves in wet mud, but unless the weather be unusually warm they seldom indulge in such pastimes after sundown. When heated, they squirt water over their backs from their trunks, and when unable to obtain water externally, they have the power of drawing fluid from their mouths or throats by the aid of the trunk. At times, when exposed to a scorching sun, they protect themselves by throwing dust, leaves, or straw on their backs.

Swimming. In common with its African cousin, the Indian elephant is an excellent swimmer, and is perhaps more thoroughly at home in the water than any mammal whose habits are not essentially amphibious or aquatic. Mr. Sanderson states that a herd of seventy-nine elephants under his charge once had a swim of six hours' duration, and after a short rest on a sandbank accomplished their journey by water in three hours more. An elephant swims very deep in the water, sometimes only showing the end of its trunk, but at others allowing the greater part of its head to appear above the surface. In the case of tame individuals the mahout, or driver, generally stands on the neck of his animal. The pace that an elephant swims is estimated at about a mile an hour; but this, of course, depends largely on whether the animal is swimming with or against the stream. Unlike that of a hippopotamus, the body of a freshly-killed elephant floats in water.

Paces.

In regard to movement on land, Mr. Sanderson says that "the only pace of the elephant is the walk, capable of being increased to a fast shuffle of about fifteen miles an hour for very short distances. It can neither trot, canter, nor gallop. It does not move with the legs on the same side together, but nearly so. A very good runner might keep out of an elephant's way



INDIAN ELEPHANTS ENJOYING THEMSELVES.

on a smooth piece of turf, but on the ground in which they are generally met with, any attempt to escape by flight, unless supplemented by concealment, would be unavailing." An elephant is totally unable to leap in either the horizontal or the vertical direction, and since its maximum length of stride is about $6\frac{1}{2}$ feet, a 7-foot ditch forms an effectual barrier to its progress. Elephants are, however, capable of ascending or descending steep and difficult places with great facility, sometimes sliding down on their bent hind-limbs. When a herd of them descends one of the steep alluvial banks bordering most of the Indian rivers, it is surprising how

rapidly the soil becomes broken down under their weight so as to form a regular sloping road.

Cries. The Indian elephant, under different circumstances, gives vent to a variety of sounds, some of which are produced in the trunk, while others originate in the throat. Of these utterances, the first, writes Mr. Blanford, is "the shrill trumpet, varying in tone, and expressive, sometimes of fear, sometimes of anger. Secondly, a roar from the throat caused by fear or pain. A peculiar hoarse rumbling in the throat may express anger or want, as when a calf is calling for its mother. Pleasure is indicated by a continued low squeaking through the trunk. Lastly, there is a peculiar metallic sound made by rapping the end of the trunk on the ground and blowing through it at the same time. This indicates alarm or dislike, and is the well-known indication of a tiger's presence."

Senses. The intelligence of the animal having been already sufficiently discussed, all that need be said about its senses is that while smell is strongly developed, both sight and hearing appear to be by no means acute.

Disposition. At most seasons of the year the Indian elephant is a timid animal, much more ready to flee from a foe than to make an attack. Solitary "rogues" are, however, frequently an exception to this rule, and sometimes make unprovoked attacks on passers-by. Indeed, there are instances on record where a "rogue" elephant has taken up a position near a road, and rendered it impassable to travellers. Females with calves are at all times dangerous to approach. Contrary to what is stated to be the case with the African species, when an Indian elephant makes a charge, it does so with its trunk tightly curled up, and it makes its attack by trampling its victim with its feet or knees, or, if a male, by pinning it to the ground with its tusks. At certain periods of the year the male elephant is subject to paroxysms of excitement, generally supposed to be due to sexual causes, and is then highly dangerous, not only to human beings, but to its fellow-animals. The creature is then said to be *mast*, or mad; and the approach of such attacks is indicated by the copious flow of a dark tar-like liquid from two small orifices in the forehead. At the first indications of one of those seizures, domesticated elephants should be promptly secured.

Breeding. Not the least remarkable fact connected with elephants in captivity, is the circumstance that in India at least they very rarely breed when in this condition; thus showing what a profound effect the change from a wild to a domesticated mode of life must have on the animal's entire organisation. It is stated, however, that in some parts of Burma and Siam, young are produced much more freely from captive females. The ordinary period of gestation is about nineteen months, but it appears that in some cases it may be a month less, while in others its duration may be as much as twenty-two months. As a rule, the young are born in the autumn, from September to November; and there is generally but one produced at a birth, although in rare instances twins occur. The new-born calf stands about a yard in height, and weighs about 200 lbs.; it suckles its parent with its mouth, and not, as has sometimes been supposed, with its trunk.

Elephant-Shooting. Elephant-shooting, which is always practised on foot, is pronounced to be the most dangerous of all sports by Sir Samuel Baker, since although many elephants may be killed without any danger or harm, it is almost inevitable that the charge of a wounded animal will have to be encountered sooner or later by the sportsman. In shooting the Indian elephant a thorough knowledge of the position of the brain in the skull is essential; as the three chief head-shots depend entirely on this. Of these three shots the one known as the front-shot should be planted in the forehead about three inches above the line of the eyes when the elephant is standing with its head in the ordinary position and facing the sportsman. When, however, the elephant is charging with its head thrown up, the front shot to prove fatal must be aimed much lower down, in the upper part of the trunk, and as the bullet has then to traverse a great thickness of flesh and bony tissue before reaching the brain, everything depends upon its penetrating power. Indeed, although elephants have frequently been killed by well-planted bullets from small-bore rifles, all who have had much experience of this sport are unanimous as to the importance of shooting with rifles of heavy calibre. The other two fatal shots in the head are the side, or temple-shot, and the rear-shot just behind the ear. The shot behind the shoulder is not in much favour.

Allusion has already been made to the generally timid and pacific nature of the wild Indian elephant; and there can be little doubt that in many cases, when these animals charge, they do so more from sudden alarm and fright than from any innate viciousness.

When an elephant does charge, it requires all the coolness and presence of mind of the sportsman to avoid a catastrophe. "A grander animated object," writes Mr. Sanderson, "than a wild elephant in full charge can hardly be imagined. The cocked ears and broad forehead present an immense frontage; the head is held high, with the trunk curled between the tusks, to be uncoiled in the moment of attack; the massive fore-legs come down with the force and regularity of ponderous machinery; and the whole figure is rapidly foreshortened, and appears to double in size with each advancing stride. The trunk being curled and unable to emit any sound, the attack is made in silence, after the usual premonitory shriek, which adds to its impressiveness. The usual pictorial representations of the Indian elephant charging with upraised trunk are accordingly quite incorrect."

In some cases the sportsman has to stalk a herd of elephants, and to pick out the finest tusker from among the males in the rear; while at other times he has to track up a particular solitary male, which may be either a "rogue" or a herd-tusker temporarily separated from his companions. When a herd discovers the presence of a foe, the individual that first scents him usually gives vent to a short, shrill trumpet, upon which the rest stand perfectly still for a few minutes before making up their minds in which direction to flee. But at other times the whole herd may make off at once, without a sound being uttered. Sometimes the herd will mistake the direction of the danger, and stampede straight for the sportsmen, whose position is then one of considerable danger; his best plan being to stand alongside a tree or clump of bamboo. In cases where they are unaccustomed to the sound of firearms, Mr. Sanderson states that elephants will stand huddled together, shrinking at the

shots, which they perhaps mistake for thunder. When first starting, they make off at a rapid pace, but soon settle down to a steady walk.

In shooting single tuskers, it is advisable that the sportsmen should be at his work betimes, as in the case of bulls belonging to a herd they usually rejoin their companions by eight or nine in the morning. When such solitary animals are feeding, the noise they make allows of a close approach without much risk of discovery. Bulls that are permanently solitary usually rest at about ten o'clock, and after that time may be found asleep, either lying down, or resting against the trunk of a tree. When first disturbed, one of these solitary tuskers makes off with a tremendous rush, but soon subsides into a walk, when he proceeds so quietly that he may disappear without the sportsman being in the least aware of it.

The following account of the death of a tusker, by Sanderson, gives some idea of the danger often encountered in this kind of sport. The narrator writes, that having ascertained that the herd comprised about fifty head, "a shrill trumpeting and crashing of bamboos about two hundred yards to our left broke the stillness, and from the noise we knew it was a tusker-fight. We ran towards the place where the sounds of combat were increasing every moment: a deep ravine at last only separated us from the combatants, and we could see the tops of the bamboos bowing as the monsters bore each other backwards and forwards with a crashing noise in their tremendous struggles. As we ran along the bank of the nalla to find a crossing, one elephant uttered a deep roar of pain, and crossed the nalla some forty yards in advance of us, to our side. Here he commenced to destroy a bamboo-clump (the bamboos in these hills have a very large hollow, and are weak and comparatively worthless) in sheer fury, grumbling deeply the while with rage and pain. Blood was streaming from a deep stab in his left side, high up. He was a very large elephant, with long and fairly thick tusks, and with much white about the forehead; the left tusk was some inches shorter than the right. The opponent of this Goliath must have been a monster indeed to have worsted him. An elephant-fight, if the combatants are well matched, frequently lasts for a day or more, a round being fought every now and then. The beaten elephant retreats temporarily, followed leisurely by the other, until by mutual consent they meet again. The more powerful elephant occasionally keeps his foe in view till he perhaps kills him; otherwise, the beaten elephant betakes himself off for good on finding he has the worst of it. Tails are frequently bitten off in these encounters. This mutilation is common amongst rogue-elephants, and amongst the females in a herd; in the latter case it is generally the result of rivalry amongst themselves. The wounded tusker was evidently the temporarily-beaten combatant of the occasion, and I have seldom seen such a picture of power and rage as he presented, mowing the bamboos down with trunk and tusks, and bearing the thickest part over with his fore-feet. Suddenly his whole demeanour changed. He backed from the clump and stood like a statue. Not a sound broke the sudden stillness for an instant. His antagonist was silent, wherever he was. Now the tip of his trunk came slowly round in our direction, and I saw that we were discovered to his fine sense of smell. We had been standing silently behind a thin bamboo-clump, watching him, and when I first saw that he had winded us, I imagined he might take himself off. But his frenzy quite overcame all fear for the moment; forward

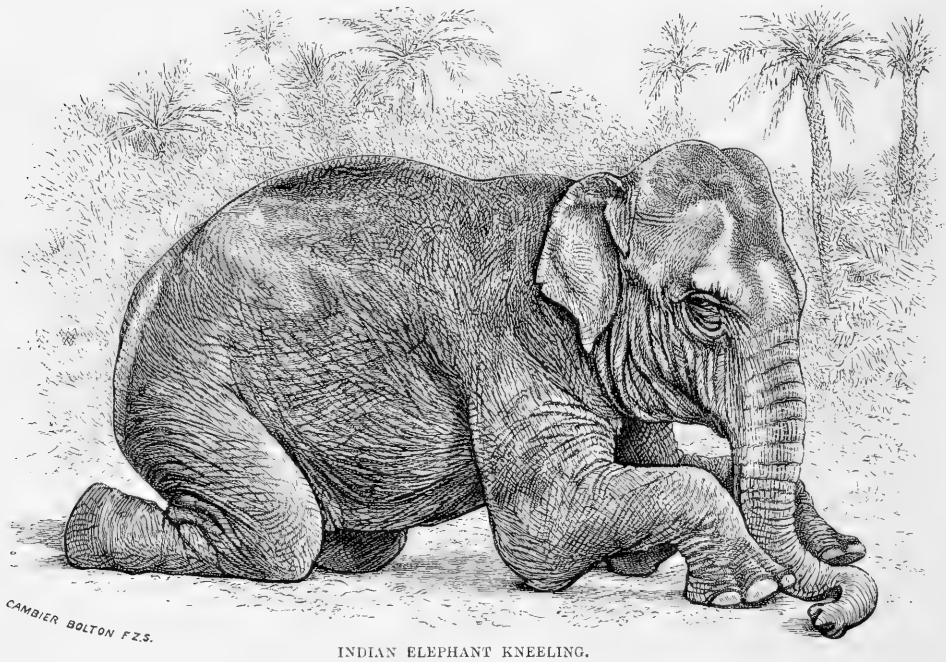
went his ears and up went his tail, in a way which no one who has once seen the signal in a wild elephant can mistake the significance of, and in the same instant he wheeled round with astonishing quickness, getting at once into full speed, and bore straight down upon us. The bamboos by which we were partly hidden were useless as cover, and would have prevented a clear shot, so I stepped out into open ground the instant the elephant commenced his charge. I gave a shout in the hope of stopping him, which failed. I had my No. 4 double smooth-bore loaded with ten drams in hand. I fired when the elephant was about nine paces distant, aiming into his curled trunk about one foot below the fatal bump between the eyes, as his head was held very high, and this allowance had to be made for its elevation. I felt confident of the shot, but made a grand mistake in not giving him both barrels; it was useless to reserve the left as I did at such close quarters, and I deserved more than what followed for doing so. The smoke from the ten drams obscured the elephant, and I stooped quickly to see where he lay. Good heavens! he had not been even checked, and was upon me! There was no time to step right or left. His tusks came through the smoke (his head being now held low) like the cow-catchers of a locomotive, and I had just time to fall flat to avoid being hurled along in front of him. I fell a little to the right; the next instant down came his ponderous fore-foot within a few inches of my left thigh, and I should have been trodden on had I not been quick enough, when I saw the fore-foot coming, to draw my leg from the sprawling position in which I fell. As the elephant rushed over me he shrieked shrilly, which showed that his trunk was uncoiled; and his head also being held low instead of in charging position, I inferred rightly that he was in full flight. Had he stopped I should have been caught, but the heavy bullet had taken all the fighting out of him. Jaffer had been disposed of by a recoiling bamboo, and was now lying almost in the elephant's line; fortunately, however, the brute held on. I was covered with blood from the wound inflicted by his late antagonist in his left side; even my hair was matted together when the blood became dry. The mahout had jumped into the deep and precipitous nalla to our left at the commencement of hostilities."

Capture.

Since the elephant in India will not breed to any appreciable extent in captivity, the stock has to be continually replenished by the capture of wild individuals. The methods in vogue are, by driving into *keddas*, or enclosures; by hunting with trained females; by means of pitfalls; and by noosing from the backs of specially-trained tame animals. Of these, the first only is employed for the capture of whole herds.

A kedda-party in Bengal comprises three hundred and seventy men, who go out during the winter prepared for a sojourn of two or three months in the jungle. When a herd is discovered, the party divide and go off in opposite directions so as to surround it, leaving two of their number at distances of about every fifty yards, or rather more. When complete, the circle should have a circumference of six or eight miles; and when once found, it must be the fault of the men if the herd is not captured. A light fence of split bamboo is rapidly formed round the ring, as are likewise shelters for the men; and the animals are kept in by firing shots by day and by lighting bonfires at night. After the first two days, however, if the ring be sufficiently large and contain plenty of cover, the elephants give but little

trouble. In the middle of the circle the construction of the kedda is then pushed on apace. This is built in a secluded spot, and is formed of massive posts of about twelve feet high, supported by props, and arranged in a circle of from twenty to fifty yards in diameter, with an entrance of about four yards in width. From the entrance proceed two diverging lines of palisades, which at their terminations, a hundred yards or so from the gate, are about fifty yards asunder. When all the arrangements are complete, the herd is driven down the funnel-shaped entrance, and when within the kedda itself imprisoned by dropping a kind of portcullis at the gate. After a time the process of securing the various members of the herd commences; for which purpose tame elephants, each carrying a mahout on its neck and a rope-tier behind are employed. These tame elephants separate the wild ones



INDIAN ELEPHANT KNEELING.

from their companions one by one, when the hind-legs of the captives are tied together with ropes. Each captive then has a rope placed round its neck, and another round one hind-leg; after which it is led out and secured to a tree in the neighbouring forest, where it remains until sufficiently tamed to undergo further treatment.

As the finest tuskers are seldom caught in the keddas, another plan is adopted for their capture. A party of four or five trained female elephants, with their mahouts (who partially conceal themselves under blankets), proceed to the resorts of a solitary wild tusker; and gradually approach him by grazing in an unconcerned manner, unless the male saves them this trouble by coming up of his own accord. Having established an acquaintance, the females remain constantly with the male until he is thoroughly tired out and in need of sleep, which may not take place for two or three days; during which time the mahouts have been relieved

one by one by relays. When the wild tusker is sound asleep, the females close up around him, upon which two of the mahouts slip off, and tie his hind-legs securely together. Sometimes this is all that is then done, but in other cases he is made fast to a tree. When awakened, the male, if tied to a tree, makes every effort to escape, but in vain; while, when his legs are merely hobbled, he makes off in the best way he can. In the latter case he is followed by the females until exhausted, when he is made fast to a neighbouring tree. The efforts made by elephants thus caught to escape from their trammels, frequently produce such injuries as to result in the death of a large percentage of the number.

Pitfalls. The pitfall mode is chiefly or entirely employed by natives, and is a barbarous one, owing to the frequency with which the bones of the animals are broken or dislocated in the fall. To obviate this a bar is usually fixed across the middle of the pit, which, although itself broken, somewhat mitigates the shock of the fall. The pits are about fifteen feet in depth, by ten and a half in length, and seven and a half in width; this relatively small area being intended to hinder the animal from digging his way out with his tusks. It is remarkable that an animal which displays such caution in venturing over bridges and other artificial structures as does the Indian elephant, should so readily fall into these pits.

Chasing. The fourth method of capture employed in India is by far the most exciting, and is in fact a simple chase. Three or four fast tame elephants, each carrying a mahout on its neck, a nooser kneeling on a small pad on the back, and a driver near the tail, are fitted with a girth round the body, attached to which is a rope with a running noose. When the wild elephants are approached, they make off at their topmost speed, closely followed by the tame ones. Two of the tame elephants select a single wild animal, and urged to their utmost speed by the blows of a spiked mallet wielded by the drivers behind, perhaps eventually come alongside of it. When this takes place, the nooses are thrown, and generally encircle the victim by the neck. The tame elephants are then checked, but if this is done too suddenly the captive may be choked; indeed, the whole party are liable to injury from being dragged down ravines or other precipitous places; and the work is at all times very harassing to the tame animals employed. This method, which is only employed in Bengal and Nipal, has the further disadvantage that only the less fleet, and therefore inferior, animals can be captured by its means.

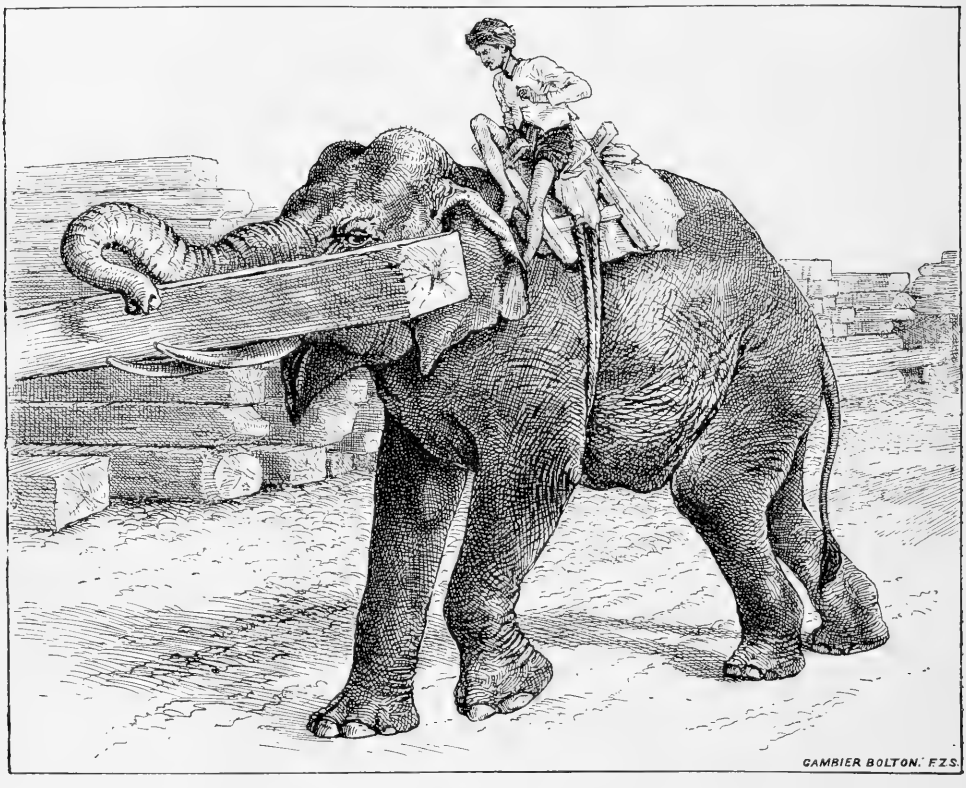
Noosing. In Ceylon wild elephants are noosed by a couple of hunters on foot, who with marvellous skill encircle the hind-legs of an animal running away from them, and make fast the end of the trailing rope to a tree.

Value. An immature female elephant is worth about £150 (we presume counting the rupee at its nominal value of two shillings), while good working females will fetch from £200 to £300. Tuskers are, however, far more valuable, ranging from £800 to £1500 or £1600, or even more if all their "points" be perfect.

Uses of Elephants. The domesticated elephant is largely employed in India for the transport of heavy camp-equipage, for dragging timber to the rivers, and in lieu of horses for artillery: and is of especial value in traversing districts where roads are either wanting, or are so bad as to be impassable for other animals when laden. Elephants may be employed either as beasts of burden or of draught;

and in the former case their loads should not exceed half a ton for continuous marching, while in hilly districts they should be reduced to about 7 cwt. In dragging timber of moderate dimensions, a short rope is attached to one end of each log, which the elephant seizes between his teeth, and thus raising his burden from the ground, half carries and half drags it away. Tuskers are both stronger and more useful than females, since their tusks often aid them in the performance of their duties.

The majority of the animals employed in tasks like the above, belong to what



ELEPHANT STACKING TIMBER.

the natives term the inferior castes; tuskers of the finest and most approved form being far too expensive to be put to such uses. The majority of such animals are, indeed, purchased by the native princes, by whom they are used in state pageants, and the taller the animal, the greater his value.

By the sportsman the elephant, as we have already had occasion to mention, is extensively employed in tiger-shooting; and, indeed, in many districts this sport can only be enjoyed by the aid of these animals. For sporting purposes, the elephant carries a howda, which should be so constructed as to combine lightness with strength, and to allow of the occupant firing from it with equal ease in any direction. One of the most remarkable features connected with the taming of the Indian elephant, is the extent to which its natural timidity in presence of its dreaded enemy the tiger may be overcome by means of careful training. To enter

into any particulars with regard to the mode of employment of elephants in tiger-hunting, would, however, be entirely beyond the scope of a work on Natural History.

The Mammoth. As being extremely closely allied to the living Indian species, the extinct elephant of the Pleistocene deposits of Europe and Northern Asia, commonly known as the mammoth (*E. primigenius*), may be conveniently noticed in this place. So close, indeed, is the relationship between the mammoth and the Indian elephant, that it may be a great question whether they are anything more than varieties of one single species, specially modified for the climates of their respective habitats. It is true that the tusks of the mammoth are much more curved upwards than are those of the Indian elephant, and assume a spiral curvature; while the plates of the molar teeth are narrower and more numerous. These, however, are differences which scarcely constitute more than a well-marked variety; and it is noteworthy that when we reach the warmer regions of Asia Minor, the place of the mammoth was taken during the Pleistocene period by an allied species known as the Armenian elephant (*E. armeniacus*), which had molar teeth intermediate between those of the former and those of the living Indian elephant. In Siberia, where its carcases have been found preserved in the frozen soil, the body of the mammoth was covered with a thick coat of brownish woolly fur, among which were a number of longer bristly black hairs; but it is by no means certain that the animal was thus protected from cold in the more southern and warmer portions of its habitat. Apart, however, from this, the discovery alluded to on p. 529, that the Indian elephant retains traces of a woolly covering similar to that of the mammoth, shows that in this respect there is no essential difference between the two forms; and indicates that the development or loss of the hairy coat was entirely due to climatic conditions.

The mammoth is found in great abundance in Siberia, its remains becoming more numerous the further north we proceed. In Northern Europe, with the exception of the district to the East of the White Sea, it is, however, rare or unknown; none of its remains having been discovered in Norway, and but few in Denmark and Sweden. Although rare in Scotland and Ireland, mammoth-remains are extremely common over the greater part of England, and a large area of Central Europe. They abound in France and Germany, and in Italy extend as far south as Rome, but according to Sir H. H. Howorth are unknown southward of the Pyrenees. Great numbers are dredged from the Dogger Bank in the North Sea. From Eastern Asia the mammoth travelled across what is now Behring Strait into Alaska; but in the United States, and extending as far south as Texas and Mexico, the place of the mammoth was taken by a closely-allied species or variety, known as the Columbian elephant (*E. columbi*).

That the mammoth lived in Siberia in the area where its frozen remains are found, may be considered certain; and there is considerable evidence to indicate that the climate of these regions was far less inclement than it is at present. This, however, only renders it the more difficult to account for the manner in which its remains were—as they must have been—frozen up in the soil immediately after death. Sir H. Howorth calls in the aid of a sudden cataclysmic change from heat to extreme cold; but it is somewhat difficult to accept such a theory. However,

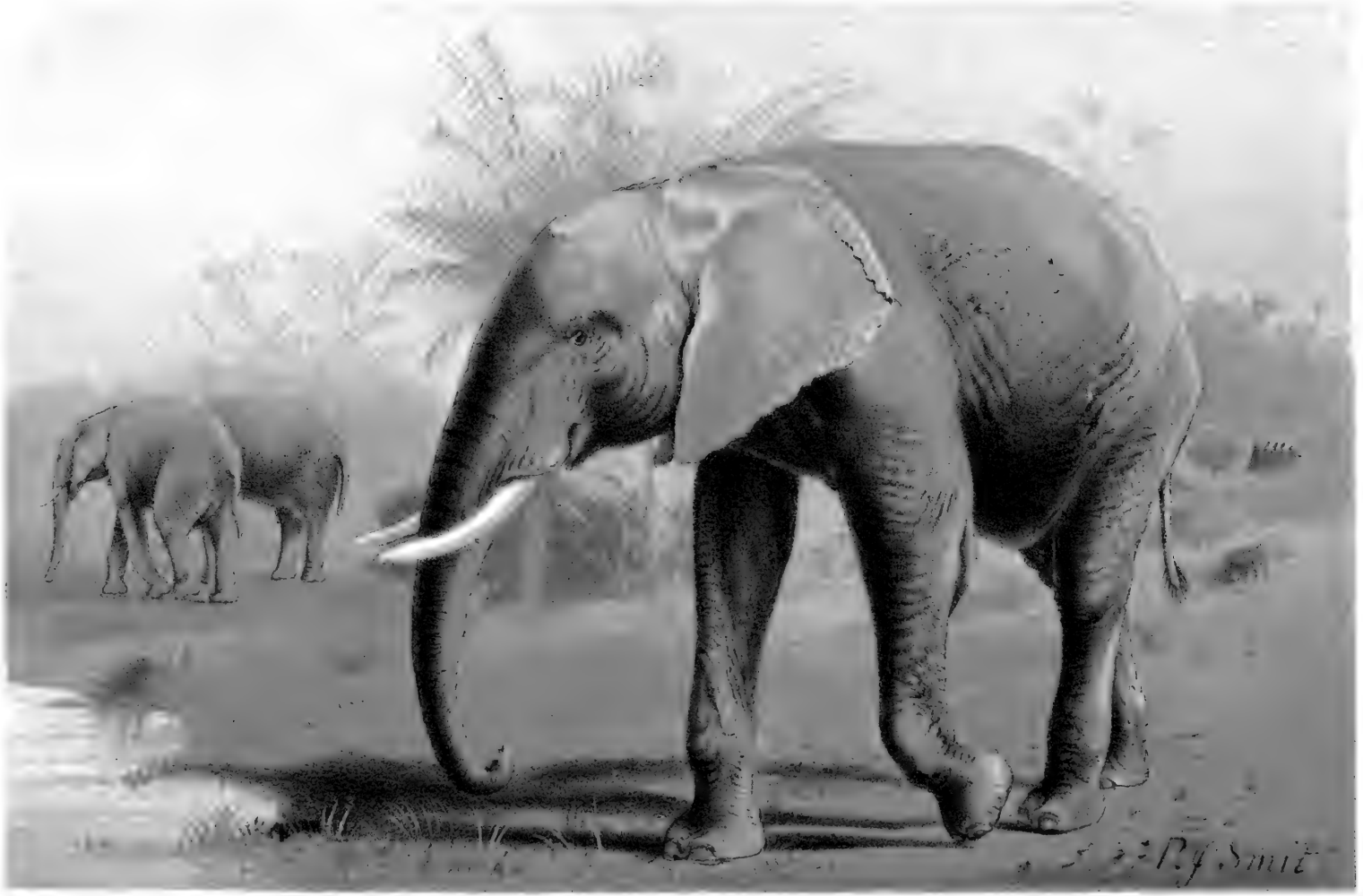
without some such explanation, the mode of entombment remains a complete puzzle. In Europe the mammoth seems to have made its first appearance before the great cold of the glacial period; a fact, which so far as it goes, is in favour of Sir H. Howorth's view, as tending to show that the creature never inhabited a very cold climate.

Numerous finds of frozen carcases of mammoths in the soil of Siberia have been recorded; but it may be pretty safely asserted, that these form only a small proportion of those which have been brought to light by the action of the weather during the historic period. Of the recorded examples, almost the earliest is one found on the river Alasega in the year 1787; and somewhere about the same time another appears to have been discovered at the mouth of the Lena; while a third occurred in 1805 on the shores of the Polar Sea. The most celebrated of the earlier finds is, however, the one recorded by the naturalist Adams, in 1806, which had been disclosed by the gradual melting of the ice on a peninsula at the mouth of the Lena. The first indication of this carcase was noticed by a native in the year 1799, who observed a hummocky mass in the ice, which melted in the summer of 1801 sufficiently to show one tusk and the side of the monster. The carcase was then entire, showing the eyes and trunk well preserved, and the thick coat of wool and hair clothing the skin. During the cold summer of 1802 the ice melted little, but in the following year the carcase slid down on to a sandbank; and in 1804 a native hacked out and carried off both tusks. It was not till two years later, that Adams arrived on the scene; by which time the dogs of the yakuts had consumed nearly all the flesh, while one limb had been removed bodily. The rest of the skeleton, together with a large amount of hair, were, however, taken to St. Petersburg, where they are now preserved.

Another mammoth-mummy was discovered in 1840 on a tributary of the Yenisei, and its skeleton taken to the Museum at Moscow. Some long stiff hair, of a reddish colour, found with this specimen, probably belonged to the mane; the existence of such a mane having been proved by the rough sketches made by the yakuts of Adams's specimen. A half-grown mammoth, with part of the skin remaining, was discovered in 1843 near the river Taimyr, only a comparatively short distance from the Polar Sea, in 1843. Some time between 1840 and 1850, a well-preserved carcase was discovered in the circle of Yakutsk, on the banks of the river Kolyma. It had a long mane, extending from the head to the tail; and fragments of twigs, on which the animal had been browsing shortly before its death, were found between its teeth.

Between 1860 and 1862 the yakuts discovered another frozen carcase on a tributary of the Lena; and an expedition from St. Petersburg, which unfortunately arrived too late, was despatched to secure the prize. The summer 1867 revealed another of these frozen carcases, this time near the Polar Sea in the neighbourhood of the River Alasega, and some distance beyond the northern limit of trees. About the same time news arrived of the discovery of a mammoth on the river Kolyma; while a third was discovered in 1870 near the Alasega.

These isolated finds of frozen carcases give no idea of the number of mammoths that inhabited Siberia at a time when its climate must apparently have been far less rigorous than at present; and in order to obtain some adequate conception on

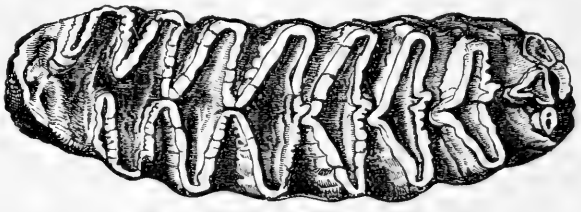


AFRICAN ELEPHANT.

this point, we must turn our attention to the trade in mammoth ivory. It appears that in 1872 no less than 1630 of these tusks, and in the following year 1140, were imported into England; and it may be estimated that for a long time fully 120,000 lbs. weight of fossil ivory found its way year by year into the market. This means that within a period of twenty years, over 20,000 mammoths must have been discovered; which affords ample proof that Siberia was as thickly inhabited by these animals, as was ever Africa by the elephant of modern times. It may be added that only about 14 per cent. of the tusks imported afford first-class ivory, in addition to which about 17 per cent. are capable of being used where ivory of the best quality is not required.

The African Elephant (*Elephas africanus*).

The African elephant differs widely from its Asiatic congener, not only in external form, but likewise as regards the structure of its molar teeth; the males also reaching larger dimensions than those ordinarily attained by the latter. The most striking external characteristic of the African species is the enormous size of the ears, which, when in repose, completely cover the shoulders, but during periods of excitement are elevated at right angles, and thus communicate a most extraordinary appearance to their owner. The head is also much more convex in the region of the forehead, the eye is larger, and the extremity of the trunk, instead of having one long finger-like process on its front edge, has two nearly equal-sized processes, one in front and the other behind. The colour of the skin is also somewhat darker. In general form, the African species is distinguished by the middle of the back being hollowed, and the shoulder the highest point, while the hind-foot carries three, in place of four, nails. As a general rule, both the males and females are furnished with well-developed tusks, which attain larger dimensions than those of the Indian elephant; but Mr. Blanford states that in Eastern and Northern Abyssinia all the elephants appear to be almost tuskless, or to have very small and short tusks. The molar teeth are distinguished by the smaller number and greater thickness of their plates; each of these plates expanding in the middle in an angulated form, so that when worn (as shown in the accompanying figure) each plate presents a lozenge-shaped area of ivory bordered by enamel. Moreover, the enamel is not puckered in the manner characterising the molars of the Indian species. The number of plates in the first molar is usually three, in the second six, in the third and fourth seven, in the fifth eight, and in the last ten.



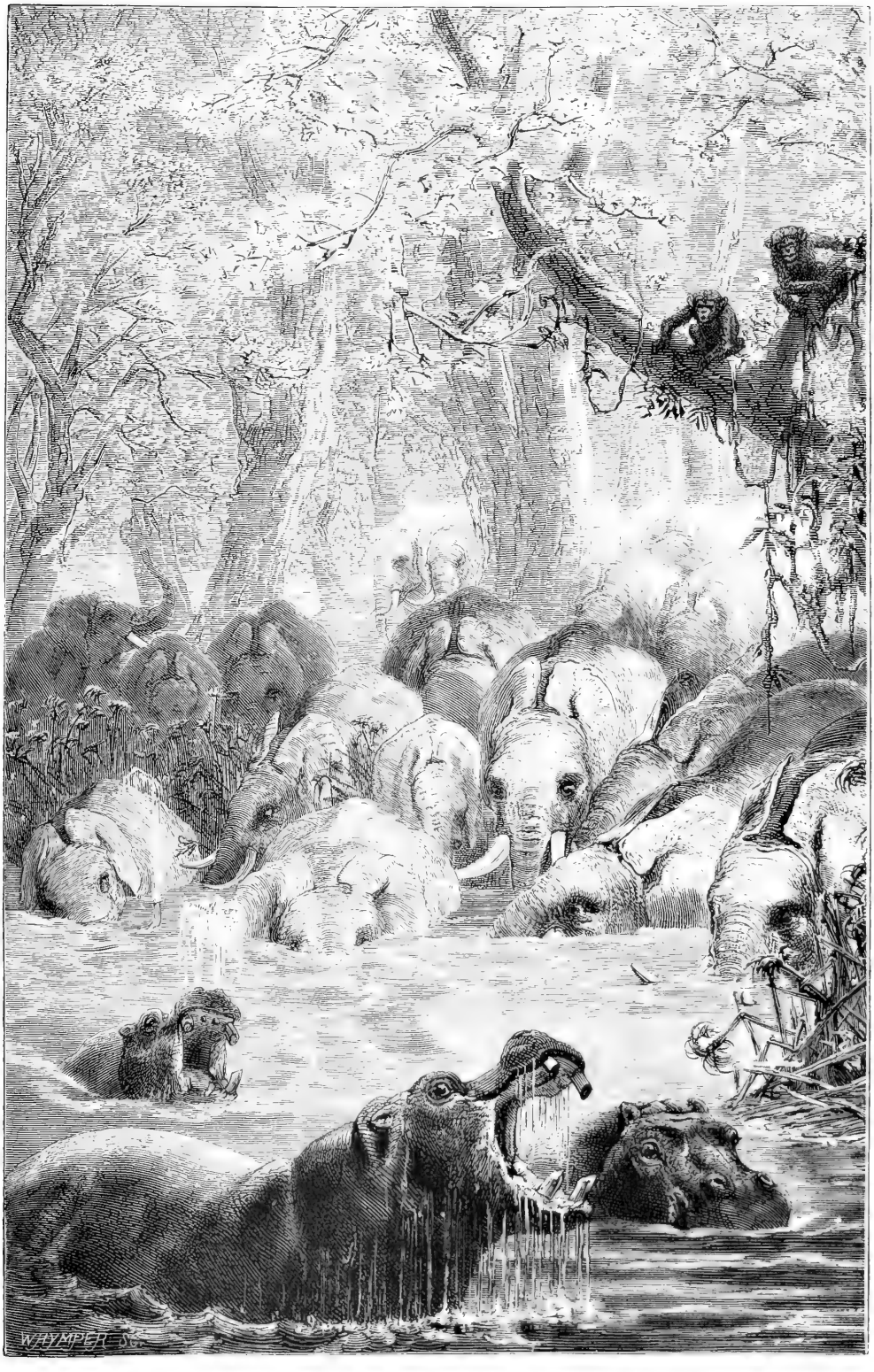
A RIGHT UPPER MOLAR TOOTH OF THE AFRICAN ELEPHANT ($\frac{1}{3}$ nat. size). (From Sir R. Owen.)

Dimensions. That the African elephant frequently attains a height of 10 feet and over at the shoulders is well ascertained, but we have no records of its maximum dimensions in the wild state. A male killed in South Africa by H.R.H. the Duke of Coburg, which stood 10 feet at the withers, had a length

of 23 feet 5 inches from the tip of the trunk to the end of the tail, with a maximum girth of 16½ feet; its weight being 4 tons 8 cwts. and 4 lbs. In one killed near Lake Nyasa by Sir John Kirk, the height at the withers was 10 feet 3 inches, the total length 25 feet 2 inches, and the maximum girth 18 feet. These dimensions are, however, largely exceeded by those of the well-known "Jumbo," formerly in the London Zoological Society's Gardens, whose height at the withers was 11 feet, and his weight 6½ tons. As this animal was brought up in captivity, there can be no doubt but that wild individuals must attain considerably larger dimensions; and Sir Samuel Baker states that he has seen very much larger animals than "Jumbo."

In regard to the dimensions of the tusks, Sir S. Baker gives about 140 lbs. for the average weight of a pair in a full-grown male; but owing to the exclusive use of one tusk for digging, the two would not be of equal weight. The same writer states that a single tusk sold in London in 1874 weighed 188 lbs.; and one in the possession of Sir E. G. Loder weighs 184 lbs., with a length of 9 feet 5 inches, and a girth of 22½ inches. Another mentioned by Sir S. Baker weighed 172 lbs.; while one recorded by Sir J. Kirk had a weight of 160 lbs., a length of 9 feet 4 inches, and a girth of 20½ inches. A fine specimen in the collection of Mr. Rowland Ward has the same length as the last, but its weight is 110 lbs., and its girth 18 inches. The longest on record appears, however, to be one mentioned by Gordon Cumming, of which the length is given as 20 feet 9 inches, and the weight 173 lbs.

Distribution. Although its fossilised remains have been found in the superficial deposits of Spain, Sicily, and Algeria, this species is now confined to Africa south of the Sahara, where it was formerly spread over the whole of the wooded districts. Owing, however, to constant persecution for the sake of its tusks, the African elephant has been greatly reduced in numbers, and is now practically exterminated from large areas in the southern portion of the continent. Indeed, if measures are not shortly taken for its protection, it stands a good chance of sharing the fate which has already befallen the quagga and Burchell's rhinoceros; although it may survive for some time in the more remote equatorial districts and the Sudan. In the districts lying to the southward of the Zambesi, Messrs Nicolls and Eglington state that, with the exception of a few scattered herds in the more unfrequented parts of Matabililand, and the extremity of North-Eastern Mashonaland, elephants "are now only met with in anything like reasonable quantities in the impenetrable bush of the low-lying coast country in the region of Sofala Bay. A few herds may possibly exist in the extreme north and north-east of Ovamboland, bordering on the Cuneni and Okavango Rivers; but if so, they are only a few tuskless males or young females. The last herd frequenting the Botletli and the neighbourhood of Lake Ngami was completely destroyed three years ago [1889] by Bechuanas; and although a good many are certainly to be met with in the country between the Chobi and Zambesi, it is improbable that they will survive the attacks of the Barotsi natives during the next two or three years." Some herds are preserved in a protected state by the Government in the forests in the east of the Cape Colony. In East Africa, in the Kilima-Njaro district, elephants are still fairly plentiful. There they ascend, at



THE HAUNT OF THE AFRICAN ELEPHANT.

certain seasons of the year to an elevation of nine thousand or ten thousand feet among the damp forests clothing the sides of the mountain; while they are found at heights of from seven thousand to eight thousand feet above the sea-level in the Abyssinian highlands.

Habits.

All observers seem to agree that the African elephant is a more powerful and more active animal than its Asiatic cousin, displaying marvellous capacities for getting over precipitous and rocky ground, and being altogether more rapid in its movements. Moreover, most writers consider its disposition is decidedly fiercer than that of the other species.

Although there is probably some local difference in this respect, the African elephant, according to Sir Samuel Baker, is far less intolerant of intense solar heat than the Indian species; and in the Sudan these animals may frequently be observed "enjoying themselves in the burning sun in the hottest hours of the day, among plains of withered grass, many miles from a jungle."

The difference in the structure of their molar teeth would of itself be an indication of a marked distinction in the diet of the two species; and from what we know in the analogous instance of the two African species of rhinoceros it would be inferred that the nutriment of the African elephant is composed of coarser and harder substances than those eaten by the Indian species. This inference appears to be supported by the results of observation. Thus, in parts of South Africa, Livingstone states that great numbers of trees may be seen "broken off by elephants a foot or two from the ground, in order that they may feed on the tender shoots at the tops; the trees thus seem pollarded from that point. In spite of this practice, the elephant never seriously lessens the number of trees; indeed, I have often been struck by the very little damage he does in a forest. His food consists for the most part of bulbs, tubers, roots, and branches; the natives in the interior believe that he never touches grass; and the only instance I saw of his having grazed was near Teti, when the grass was in seed, and when he might have been attracted by the farinaceous matter, which exists in such quantities in the seed that the natives collect it for their own food." In another passage the great explorer states that the African elephant "is a most dainty feeder, and particularly fond of certain sweet-tasted trees and fruits, such as the mohonono [a tree said to resemble the cedar in appearance], the mimosa, and others, which contain much saccharine matter, mucilage, and gum. He may be seen putting his head to a lofty palmyra, and swaying it to and fro to shake off the seeds; he then picks them up singly and eats them. Or he may be seen standing by the masuka and other fruit-trees, patiently picking off the sweet fruits one by one. The selection of these kinds of food accounts for the fact that herds of elephants produce but small effect on the vegetation of a country—quality being more requisite to them than quantity."

From his experience in the Sudan, Sir Samuel Baker observes that "the African elephant is a more decided tree-feeder than the Indian, and the destruction committed by a large herd of such animals when feeding in a mimosa-forest is extraordinary; they deliberately march forward, and uproot or break down every tree that excites their appetite. The mimosas are generally from 16 to 20 feet high, and, having no tap-root, they are easily overturned by the tusks of the

elephants, which are driven like crowbars beneath the roots, and used as levers, in which rough labour they are frequently broken. Upon the overthrow of a tree, the elephants eat the roots and leaves, and strip the bark from the branches by grasping them with their rough trunks." In another passage the same writer expresses his belief that two elephants may sometimes unite their strength in order to overthrow a tree of more than ordinary size. The discrepancy in the two foregoing accounts as to the amount of damage inflicted by elephants in a forest, may be accounted for by the circumstance that while in the one district their food consists largely of twigs and fruits, in the other it is mainly composed of bark and roots. In South-Eastern Africa Mr. Selous bears testimony to the digging habits of the elephant, stating that he has seen large areas of sandy soil ploughed up by the tusks of these animals in their search for roots.

In digging, as already incidentally mentioned, it appears that the elephant always uses one particular tusk, which, in consequence, is much more worn than the other. According to Sir S. Baker, it is nearly always the right tusk which is selected for this duty; and the one so used is termed by the Sudanis the *hadam*, or servant. A curious question arises whether this preferential use of the right tusk has any connection with our own right-handedness.

In Southern Africa, at least, elephants drink almost every night, but only rarely during the day. In that part of the continent they seek the deepest shades of the forest during the heat of the day, and generally appear to sleep in a standing posture.

The African elephant associates in herds of varying size, which appear to be generally family parties; but the old bulls may be solitary, in pairs, or in small parties, and keep apart from the larger herds, which usually consist of young males, females, and calves. One of the largest herds seen by Mr. Selous was estimated to contain from one hundred to two hundred head, but such assemblages are rare. In many parts of Africa, including Abyssinia, Kilima-Njaro, and the Sudan, elephants undertake periodical migrations, apparently necessitated by the supply of food, or induced by the ripening of certain kinds of fruit in particular districts. At such times it appears that the old bulls rejoin the herds to which they belong. Once, and once only, Sir S. Baker had the opportunity of witnessing such a migration, which he describes as follows:—"We were marching through an uninhabited country for about thirty miles, and, in the midst of beautiful park-like scenery, we came upon the magnificent sight of vast herds of elephants.

"These were scattered about the country in parties varying in number from ten to one hundred, while single bulls dotted the landscape with their magnificent forms in all directions. In some places there were herds of twenty or thirty, entirely composed of large tuskers; in other spots were parties of females with young ones interspersed, of varying growth; and this grand display of elephantine life continued for at least two miles in length as we rode parallel with the groups at about a quarter of a mile distant. It would have been impossible to guess the number, as there was no regularity in their arrangement, neither could I form any idea of the breadth of the area that was occupied."

In describing his first view of the largest company of elephants he ever encountered, Oswell writes that "as I got clear of the bush I came upon at least

four hundred elephants standing drowsily in the shade of the detached clumps of mimosa-trees. Such a sight I had never seen before, and never saw again. As far as the eye could reach, in a fairly open country, there was nothing but elephants. I do not mean in joined masses, but in small separate groups. Lying on the pony's neck, I wormed in and out, looking for the bulls whose 'spoor' we had been following, and while doing so was charged by a very tall, long-legged, ugly beast, who would take no denial, and I was obliged to kill him."

Pace. It has already been stated that the maximum pace of the Indian elephant is estimated at about fifteen miles an hour; but this can only be maintained for a couple of hundred yards or so, after which the rate sinks to eight or six miles an hour. On the other hand, Sir Samuel Baker is of opinion that the African elephant might be able to maintain the maximum pace of fifteen miles an hour for a hundred yards longer than its Asiatic cousin, and that it would settle down to a pace of ten miles an hour, which could be kept up for at least that period of time. The relatively longer limbs and stride of the African species fully bear out this view as to its speedier movements.

Senses. The sense of scent appears to be very strongly developed in this species, inasmuch as it can discover the presence of a human being at an immense distance when the wind is favourable. As soon as an elephant scents a man, it starts off at once at a rapid pace, which will be maintained sometimes for hours; and since in most parts of Africa the wind is constantly veering, this constitutes one of the great difficulties in elephant-stalking. On the other hand, the sight of these animals is most defective: and it does not appear that their hearing is particularly good. On account of these deficiencies, it is possible to approach a wild African elephant from the leeward to within a very short distance: and we have been informed, on good authority, that a hunter once wagered that he would write his initials on the hind-quarters of one of these animals while alive, and that he actually succeeded in doing so.

Domestication. It is somewhat curious that the natives of Africa display no aptitude for the domestication of the wild animals of their country, in which respect they stand in marked contrast to the Malays and other Eastern nations. In the later ages of Rome, as shown on coins, the African elephant was tamed and exhibited in the arena: and these animals are commonly stated to have been employed by the Carthaginians in the Punic wars (B.C. 264–216), no less than thirty-seven of them accompanying Hannibal's army across the Alps. On this point, however, Oswell writes as follows:—"I believe some people suppose the Carthaginians tamed and used the African elephants; they could hardly have had mahouts, Indian fashion, for there is no marked depression in the nape of the neck for a seat, and the hemming of the ears, when erected, would have half smothered them. My knowledge does not allow me to raise any argument on this point: but might not the same market have been open to the dwellers at Carthage, as was afterwards to Mithridates, who, I suppose, drew his supply from India, where they have been broken and made to do man's work from time immemorial." In a note he adds that "I know in the representations on the medals of Faustina and of Septimius Severus the ears are African, though the bodies and heads are Indian: but these were struck nearly four hundred years after Carthaginian times, when

the whole known world had been ransacked by the Romans for beasts for their public shows; and I still think it possible that the Carthaginians — the great traders and colonisers of old—may have obtained elephants, through some of these colonies, from India." From the disposition of "Jumbo," it may be inferred that the species could be as easily tamed, and would prove as docile as the Indian elephant; but there is the difficulty that the natives of Africa probably could not be trained to act as efficient drivers, and without a dependable native attendant the best elephant would be worse than useless.

Hunting. The general testimony of those who have had experience of both the African and the Indian elephant points to the conclusion that the former is the more dangerous animal of the two, and the one that is more ready to charge. The females, especially those that are barren and have small tusks, are said to be far more dangerous than males, frequently charging without the least provocation, even when unwounded; and it is stated that hunters will sometimes take the trouble to kill one of these worthless females before attacking the tuskers. Indeed, Mr. W. H. Drummond is of opinion that the greater number of accidents that have occurred in African elephant-shooting may be set down to females. From the testimony of Gordon Cumming, supported by that of the writer last quoted, it would appear that the African elephant, unlike its Indian cousin, charges with its trunk uplifted, and loudly trumpeting.

Pits. Previous to the introduction of firearms, it appears that in South and South-Eastern Africa, at any rate, the natives but seldom attacked the elephant, and effected little, if any, diminution in its numbers. Occasionally, as narrated by Livingstone, they attacked the unfortunate animal with assegais, and gradually harried it to death from the loss of blood caused by hundreds of weapons. In other cases poisoned arrows were the weapons used. A more general method is that of digging pits in the paths frequented by the elephants on their way to water. These pits, according to Sir S. Baker, are usually twelve or fourteen feet in depth, and are covered with light wood and branches or reeds, upon which a thin covering of grass is spread. In some cases Sir Samuel states that several individuals out of a herd may be captured in this manner in Central Africa; the animals being put to death, when thus helpless, with spears. In the Kilima-Njaro district, however, the pit system, according to Mr. Hunter, does not appear to be very successful.

By Fire. During the dry season, when the grass of ten or fourteen feet in height is as inflammable as tinder, the natives of Central Africa have a cruel way of killing elephants by forming a circle of fire round a herd. As the fiery circle, which may be a couple of miles in diameter, gradually contracts, the elephants (to quote from Sir S. Baker's graphic description) "at first attempt to retreat, until they become assured of their hopeless position; they at length become desperate, being maddened by fear, and panic-stricken by the wild shouts of the thousands who have surrounded them. At length, half-suffocated by the dense smoke, and terrified by the close approach of the roaring flames, the unfortunate animals charge recklessly through the fire, burnt and blinded, to be ruthlessly speared by the bloodthirsty crowd awaiting this last stampede." As many as a hundred, or even more, may be, it is said, killed by this method on a single occasion.

Hamstringing. The intrepid Hamram Arabs of the Sudan slay the elephant in the same manner as the rhinoceros, by hamstringing it with a long two-edged sword. Three or four mounted hunters, singling out a tusker and separating it from its fellows, follow it until, tired out, the animal faces its pursuers, and prepares to charge. Directly it does so, the hunter who is the object of the charge puts his horse to a gallop, and is closely followed by the elephant. Thereupon, two of his companions follow at their best pace behind; and as soon as they come up with the fleeing animal, one seizes the reins of the horse of his fellow, who immediately leaps to the ground, and with one blow of his huge sword divides the tendon of the elephant's leg a short distance above the heel. The ponderous beast is at once brought to a standstill, and is at the mercy of its aggressors.

A somewhat similar method, according to Mr. Selous, was formerly practised in Mashonaland, only there the hunters went on foot, and their weapon was a broad-bladed axe; with this they crept up behind a sleeping elephant, and severed the back tendon of the leg in the same manner as above.

Weighted Spears. Other tribes in the same district employ a heavily-weighted spear, which is plunged into the animal's back by a hunter seated on a bough overhanging one of the most frequented pathways. On receiving the weapon, the elephant of course immediately rushes off, and the weight of the spear, aided by blows from boughs, soon so enlarges the wound, that the animal quickly sinks to the ground, exhausted from loss of blood. In other districts, as in parts of Equatoria, the weighted spear is suspended from a horizontal bar fixed between two tiers or poles. The spear or knife, according to Major Casati's description, is kept in position "by a cord, which is held down by a stake that is directed horizontally towards the middle of the trap; and by another which, at a convenient angle, is interposed between this and the end. The animal, striking with his feet, loosens the contrivance, which then falls violently; the knife wounds the animal with singular exactness in the spot where the brain unites with the nape of the neck. The blow falls like a thunder-clap: and if the trap is well made, the elephant struggles and dies."

By Europeans. The European sportsman kills the African elephant either by lying in wait at one of its drinking-places, or by attacking it in the open, either on foot or on horseback. At the present day, however, most or all of the elephants remaining in South-Eastern Africa are restricted to districts infested by the tsetsi fly, where horses cannot exist, and the pursuit must consequently be undertaken on foot. Owing to the conformation of its skull, the front-shot, so frequently employed in the case of the Indian elephant, is ineffectual with the African species, and there are but two spots where a bullet may be expected to prove fatal; one of these being in the head behind the eye, and the other in the shoulder immediately behind the flap of the ear.

Stories of hairbreadth escapes from charges of the African elephant may be reckoned by the score, but we cannot refrain from quoting one narrated by Mr. Selous. That gentleman had wounded a female elephant at a time when his horse was thoroughly knocked up. On a sudden the beast turned to charge, before there was time to get a fair start. "Digging the spurs into my horse's ribs," writes the

narrator, "I did my best to get him away, but he was so thoroughly done that, instead of springing forwards, which was what the emergency required, he only started at a walk, and was just breaking into a canter when the elephant was upon us. I heard two short sharp screams above my head, and had just time to think it was all over with me, when, horse and all, I was dashed to the ground. For a few seconds I was half stunned by the violence of the shock, and the first thing I became aware of was a very strong smell of elephant. At the same instant I felt that I was still unhurt, and that, though in an unpleasant predicament, I had still a chance for life. I was, however, pressed down on the ground in such a way that I could not extricate my head. At last, with a violent effort, I wrenched myself loose, and threw my body over sideways so that I rested on my hands. As I did so I saw the hind-legs of the elephant standing like two pillars before me, and at once grasped the situation. She was on her knees, with her head and tusks in the ground, and I had been pressed down under her chest, but luckily behind her fore-legs. Dragging myself from under her, I regained my feet, and made a hasty retreat, having had rather more than enough of elephants for the time being."

As Food. Although highly appreciated by the natives, the flesh of the African elephant is coarse and rank in the extreme; portions of the trunk, although tough, are however said to be fairly good. Baked elephant's foot, cooked in the skin, and scooped out like a Stilton cheese, was formerly considered a dainty, but most of those who have tasted it of late years express their disapproval.

Extinct Elephants.

In addition to the mammoth, there are a number of other extinct elephants more or less closely allied to the living species, together with others of a totally different type. The whole of these are confined to Europe, Asia, and North Africa; the only American species being the Columbian elephant alluded to above.

Sutledje Elephant. The earliest of the species allied to the living Indian one is the Sutledje elephant (*E. hysudricus*) from the Pliocene rocks of the Siwalik Hills at the foot of the Himalaya. This species had the plates of the molar teeth very thin, but less tall and less numerous than in the Indian elephant. Its skull resembled that of the latter; and it is quite possible that in this species we may have the ancestor of both the Indian elephant and the mammoth.

The Narbada Elephant. The Pleistocene deposits of the Narbada Valley in India yield the remains of a very large elephant (*E. namadicus*), which takes its name from the locality in question. In the structure of its molar teeth, one of which is represented on p. 528, this species connects the Indian elephant with the one following. It is characterised by its very short skull, which has an enormous ridge running transversely across the forehead, and some of the bones of this species appear to indicate animals of 13 or 14 feet in height, since they are vastly longer than those of the Calcutta skeleton of the Indian elephant mentioned on p. 529. This species ranged eastwards into Japan.

Straight-Tusked Elephant. The straight-tusked elephant (*E. antiquus*) from the Pleistocene deposits of Europe, differs from the mammoth by its smaller and comparatively straight tusks, and the fewer and wider plates in the molar teeth, of which the crowns are generally narrow. Indeed, some of these teeth come so close to those of the African elephant as to indicate the near relationship between that species and the fossil one. The straight-tusked elephant ranged from Yorkshire to Algeria.

Pigmy Elephants. We are so accustomed to regard elephants as the giants of creation, that it is at first difficult to believe in the existence of a species not exceeding 3 feet in height. Yet pigmy elephants (*E. mnaidriensis* and *E. melitensis*), of which the smallest is considered to have reached only those diminutive proportions, were abundant in Malta and some of the neighbouring islands during the Pleistocene period; their remains occurring in the caverns and the rock-fissures. These elephants, many of which were not larger than a donkey, appear to have been closely related to the living African species, and were doubtless dwarfed in size from the small area of the islands they inhabited.

Southern Elephant. The southern elephant (*E. meridionalis*), from the upper Pliocene rocks of Italy and France, and also found in the forest-bed on the coast of Norfolk, and at Dewlish in Dorsetshire, was the largest of all the European species, its height at the shoulder having been estimated at upwards of 15 feet. The molar teeth of this giant have very wide crowns, with the plates very broad and widely separated from one another, and somewhat less numerous than in the African species. The flat-headed elephant (*E. planifrons*) from the Pliocene rocks of the Siwalik Hills, was an allied Indian species, distinguished from all the other true elephants by the circumstance that two of the milk-molar teeth were vertically replaced by premolars; this elephant thus having eight more teeth than any other species, and thereby showing evident traces of closer kinship with the mastodons.

Stegodont Elephants. The so-called stegodont elephants (so named from the roof-like form assumed by the ridges of their molar teeth) of India and other parts of South-Eastern Asia, form an exceedingly interesting group, which almost completely connects the true elephants with the under-mentioned mastodons. A molar tooth of one of the species of this group is represented on p. 526; this tooth, as already mentioned, being characterised by the small number of its ridges (in this instance six), which are very low and wide, with the shallow intervening valleys devoid of cement. In other species of the group the ridges were, however, somewhat more numerous and more elevated, while the valleys were partially filled with cement; and these serve to connect the figured Clift's elephant with species like the southern elephant. It will be observed that the tooth of Clift's elephant, represented on p. 526, agrees with existing species in having the transverse ridges undivided by any distinct longitudinal cleft. One of the stegodont elephants (*E. ganesa*) is remarkable for the enormous size of its tusks, those in a skull from the Siwalik Hills, preserved in the British Museum, measuring upwards of 12 feet 9 inches in length, with a maximum girth of 26 inches. Representatives of this group also occur in China, Japan, and Java.

The Mastodons.

Genus *Mastodon.*

The above-mentioned stegodont elephants so closely connect the genus *Elephas* with the extinct animals known as mastodons, that the division between the two genera is a somewhat arbitrary one. It is noteworthy that the species of mastodon most nearly related to the stegodont elephants are found in the same regions as

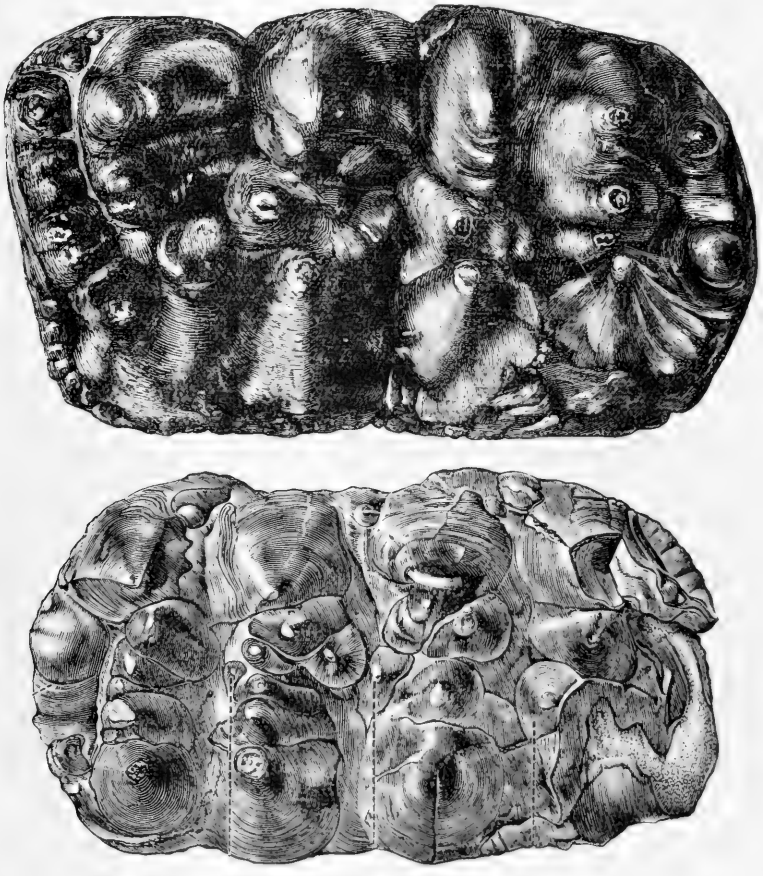
THE LAST LEFT UPPER MOLAR TEETH OF TWO SPECIES OF INDIAN MASTODONS.

The upper figure ($\frac{2}{3}$ nat. size) belongs to *M. latidens*; and the lower ($\frac{1}{2}$ nat. size) to *M. cautleyi*. In the specimen represented in the upper figure the first two ridges are partially worn, while in the lower one they are intact.

the latter, from which we may infer that the evolution of the elephants from the mastodons took place in South-Eastern Asia.

Mastodons are distinguished by their molar teeth, as shown in the accompanying figure and the one on p. 557, having comparatively few transverse ridges, which are low, and more or less completely divided by a longitudinal cleft into inner and outer columns. These ridges are separated by valleys in which there is little or no cement; and when worn down by use they exhibit more or less trefoil-shaped surfaces of ivory, quite different from the elongated ellipses formed in those of the

true elephants. In the third, fourth, and fifth molar teeth of the stegodont elephants, the number of transverse ridges is usually more than six, but in the mastodons it is generally either four (as shown in the figure below) or three, although occasionally there may be as many as five. Moreover, the sixth or last molar generally has only four or five such ridges, in place of from nine to eleven found in the stegodont elephants. In all these respects the mastodons exhibit a less specialised type of structure than that existing in the elephants, and thereby approximate to ordinary Ungulates. This simpler dental structure is further evidenced by the



TWO SPECIMENS OF MOLAR TEETH OF INDIAN MASTODONS (nat size).

Both teeth are unworn; and while the upper belongs to *M. cautleyi*, the lower belongs to *M. perimensis*.

circumstance that portions of three molar teeth may be in use at the same time, whereas in elephants only two such teeth are ever present contemporaneously on one side of the jaw. Then, again, nearly all the mastodons had premolar teeth vertically replacing their milk-molars, in the same manner as in other Ungulates.

Another peculiarity of some, although by no means all mastodons, is the presence of a pair of larger or smaller tusks in the lower as well as in the upper jaw: the extremity of the lower jaw in such species being prolonged into a spout-like projection.

There are a larger number of species of mastodon, ranging over a great part of Europe, South-Eastern Asia, and the whole of America; the earliest representatives of the group occurring in Europe in the middle division of the Miocene period. And it is noteworthy that all these earlier species had but three transverse ridges in the third, fourth, and fifth molar teeth, thus approximating the closest to other Ungulates.

One of the best known species is the North American mastodon (*Mastodon americanus*), of which teeth and bones, and sometimes entire skeletons, are found in enormous quantities in the peat and lacustrine deposits of Ohio and Missouri. This animal had enormous tusks in the upper jaw, but either none or mere rudiments in the lower jaw; and its molar teeth, with the exception of the last, had only three ridges, in which the longitudinal cleft was but slightly marked. Some of the teeth are so fresh-looking as to appear almost like those of recent elephants, and it seems that this mastodon lived on till within the human period. In height the skeleton stood about 12 feet at the shoulder.

In the Old World mastodons disappeared at an earlier date, none being known to have survived the close of the Pliocene period. Remains of several species occur in the Miocene and Pliocene deposits of the Continent, while detached teeth are occasionally found in the shelly deposits on the coast of Essex, Suffolk, and Norfolk, locally known as crags. In Northern India there were an extraordinary number of species of these animals; and among these the broad-toothed mastodon (*M. latidens*), ranging from India through Burma to Borneo, is the one approaching most closely to the elephants. In some of these Indian mastodons, as in one of those from the English crags, the inner and outer columns of the ridges of the molar teeth are completely separated from one another, and are arranged somewhat alternately; and from the nipple-like form assumed by these columns in the species in question, the generic name of *Mastodon* takes its origin.

The Dinothere.

Family *Dinotheriidæ*.

A remarkable animal known as the dinothere (*Dinotherium giganteum*), the remains of which are found in the Miocene and Pliocene rocks of Europe and India, presents us with the most generalised type of Proboscidian yet known. In this animal, which must have been fully as large as an elephant, there appear to have been no upper tusks, but the extremity of the lower jaw was sharply bent down, and terminated in a pair of very massive and somewhat curved tusks. As in the elephants and mastodons, there were no canine teeth, and the cheek-teeth carried transverse ridges. The whole of the permanent series of cheek-teeth were, however, in use at the same time, as in ordinary Ungulates, and their ridges were low and simple, and either two or three in number. Very little else is known of the skeleton of this strange animal, and there have been many conjectures as to the use of the downwardly-curved lower tusks. Possibly the creature may have been more or less aquatic in its habits, and have used these weapons to drag up water-plants from the beds and banks of lakes or rivers. On the other hand, it may

equally well have been purely terrestrial, and have used its tusks, after the manner of the African elephant, in turning up the soil in search of roots and tubers.

With this animal, an illustration of whose skull is given below, our present knowledge of the Proboscidians and their ancestors comes to an abrupt termination.

The Short-Footed Ungulates.

Suborder **Amblypoda.**

There are several extinct groups of Ungulates differing so markedly from the living forms that they cannot be included in any of the groups into which the latter are divided, and consequently have to be classed in groups by themselves.

SKULL OF DINOTHERE (greatly reduced).

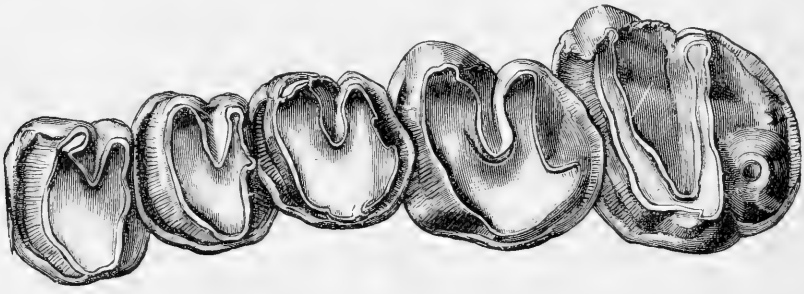
The name of Short-footed Ungulates is applied to one of these groups which is confined to the Eocene division of the Tertiary period, and is more developed in the United States than in Europe. It is represented in both continents by the coryphodons of the lower and middle Eocene beds, and in America by the uintatheres of the upper Eocene. In these animals the feet, as shown in the figure on p. 152, were very short, and were each provided with five toes, the mode of walking being partly plantigrade. The molar teeth were of the type as shown in figure on the next page, having short crowns and the ridges arranged in a V-shape in those of the upper jaw. The two bones in the fore-arm, as well as those in the lower leg, were quite distinct from one another.

The coryphodons were animals which may be compared in size to a bear, and possessed the full typical number of forty-four teeth, with the tusks (canines) well developed. They had no horn-like processes to the skull. In the fore-feet (see p. 152) only the terminal bones of the toes touched the ground, but in the hind ones the whole sole was applied to the ground, in the same manner as in a bear.

The American uintatheres, on the other hand, were much larger animals, rivalling the Indian rhinoceros in bulk. Their skulls were provided with three pairs of bony processes, which during life were probably covered with horn; and the upper tusks were developed into enormous sabre-like teeth, protected by a descending flange on each side of the front of the lower jaw. There were no incisor teeth in the upper jaw, and the first premolar tooth was wanting in both jaws,

the total number of teeth being thirty-four. Both feet resembled the fore-feet of the coryphodons in general structure, and the bones of the limbs approximate to those of the elephants. The brain was marvellously small in proportion to the size of the skull and body, indicating that these animals must have been of a stupid and sluggish nature. The uintatheres are evidently a specialised development of the coryphodon stock, which died out with the appearance of the former.

Professor Cope, who considered that the hind-feet of the coryphodon were of the same type as the front pair, remarks that the movements of this animal "doubtless resembled those of the elephant in its shuffling and ambling gait, and may have been even more awkward from the inflexibility of the ankle. But in compensation for the probable lack of speed, these animals were most formidably armed with tusks. These weapons, particularly those of the upper jaw, were more formidable than those of the Carnivora, and generally more robust." In length, one of the American species was probably about 6 feet.



THE LEFT UPPER CHEEK-TEETH OF THE UINTATHERE ($\frac{3}{4}$ nat. size). (From Marsh.)

Although the uintatheres have only been known to science for rather more than twenty years, their skulls and bones long ago attracted the attention of the wandering Indians, and such squatters and trappers whose business led them into the district known as the "Bad Lands." On returning to civilisation, these pioneers brought news of the skeletons of marvellous monsters staring at them from the rockbound cañons; and at length these attracted the attention of the late Professor Leidy, to whom belongs the honour of having made known these strange creatures to a wondering world. Describing the region where these remains occur, Professor Marsh writes that bare, treeless wastes of naked stone rise here and there into terraced ledges and strange tower-like prominences, or sink into hollows where the water gathers in salt or bitter pools. Under the cloudless sky, and in the clear, dry atmosphere, the extraordinary colouring of the rocks forms, perhaps, the most striking feature of the weird landscape.

The Macrauchenia and its Allies.

Suborder **Litopterna.**

South America was the home of numerous extinct Ungulates, quite unlike those found in any other part of the world, and which, while allied in some respects to the Odd-toed group, appear to represent three distinct suborders. Among these,

not the least remarkable was the so-called *Macrauchenia*, the typical representative of the suborder Litopterna. The members of this group are characterised by having cheek-teeth approximating in structure to those of the European palæotheres (p. 515), the upper molars having their outer wall divided into two distinct lobes. Although the long toes were arranged in the same manner as in the Odd-toed group of Ungulates, and were never more than three in number, the structure of both the wrist and ankle-joints were different. Thus, in place of the component bones of these joints alternating with one another, they were arranged directly one above another, after the so-called linear type characterising the modern elephants (see p. 528). The huckle-bone, or astragalus, of the ankle resembles that of the Odd-toed group in being grooved superiorly; but the heel-bone, or calcaneum, differed in having a small surface for the articulation of the fibula, or smaller bone of the leg, as in the Even-toed group. The long vertebræ of the neck, although showing the same flat terminal ends characterising the allied extinct South American groups, are peculiar in regard to the position of the canal for the great artery of the neck, and in this respect agree with the camels and llamas alone among living Ungulates. The thigh-bone, or femur, has a small third trochanter representing the larger one characteristic of the Odd-toed group. In build, the members of the present group were tall, slender Ungulates, with long legs, feet, and neck; and thus very different in appearance from the under-mentioned toxodonts, which were short-limbed, short-necked, and heavily-built creatures.

The Litopterna are divisible into two families, of which the first (*Macrauchenioidæ*) is represented by the macrauchenia and certain allied forms, and is characterised by the presence of forty-four teeth, forming an uninterrupted series in the jaws. Macrauchenia itself, which was discovered by Darwin in the superficial deposits of Patagonia, was an animal somewhat larger than a horse, presenting the remarkable peculiarity of having the aperture of the nostrils in the skull situated in the middle of the forehead; although during life it is probable that they terminated in a short trunk. In the lower, or Miocene Tertiaries of Patagonia the family was represented by smaller and less specialised forms (such as *Oxyodontotherium*), in which the nostrils were more normal in position, and the crowns of the molar teeth lower and simpler.

In the second family, or *Proterotheriidæ*, represented principally in the lower Patagonian Tertiary deposits, the teeth were reduced in number, and formed an interrupted series, a pair in both the upper and lower jaw being much longer than the rest. In these proterotheres the molar teeth had a considerable resemblance to those of the palæotheres; but the feet were of the general type of those of the three-toed horses, or hipparions, and in some cases it appears that only the middle toe was functionally developed.

The Astrapotheres and their Kin.

Suborder **Astrapotheria.**

In this second South American group, represented only in the Miocene deposits of Patagonia, all the species are of large size, and possess rooted cheek-teeth of a

rhinocerotic type, and lacking the marked curvature of the crown characterising those of the toxodonts. The vertebræ of the neck are comparatively short, with flattened articular surfaces, and the lateral canal piercing the transverse process in the ordinary manner. The wrist and ankle-joints were probably of the linear type; the calcaneum articulated largely with the fibula; and the astragalus was quite flat, and furnished with a large head for articulation with the navicular bone. The femur, when known, had a large third trochanter.

In both families the upper cheek-teeth were of a rhinocerotic type of structure, having a continuous external wall undivided into lobes. The group is widely distinguished from the Amblypoda by the structure of the cheek-teeth, and not improbably by the number of digits having been three in place of five. It is, however, decidedly the most generalised of the three South American extinct suborders, as is especially shown by the flattened astragalus. The remarkable similarity of the molars of *Astrapotherium* to those of rhinoceroses must probably be considered as largely due to parallelism, since the structure of the ankle in the allied *Homalodontotherium* indicates that the group diverged from the common ancestor before the modern Odd-toed Ungulates had acquired their characteristic foot-structure.

PALATE OF THE HOMALODONTOTHERE, WANTING SOME OF THE FRONT TEETH (much reduced).

In the homalodontothere, representing the first family, the teeth, as shown in the accompanying figure, comprise the full number of $i\frac{3}{3}$, $c\frac{1}{1}$, $p\frac{4}{4}$, $m\frac{3}{3}$, and have no gap; the canines being rooted and of relatively small size, and the molars with comparatively short crowns. The upper premolars are nearly as complex as the molars; and the third upper molar is not very markedly different from the two preceding teeth. The lower molars are in the form of double crescents, of which the anterior develops a loop like that found in the horses. It is stated that the toes terminated in claws. The one known species of the genus was an animal of the approximate size of the Sumatran rhinoceros.

The gigantic astrapothere, which alone represents the second family, differs from the last genus by the more specialised and reduced dentition, the enlarged teeth of each jaw taking the form of permanently growing tusks, which are worn

in nearly the same manner as those of the pigs. The molars are more distinctly rhinocerotic in structure, those of the upper jaw having taller crowns than those of the homalodontothere, with a large posterior valley, and a well-developed projection in the middle valley. The last of the series has the same triangular form as in the majority of species of rhinoceros; while the premolars are simpler than the molars. In the lower jaw the molars form nearly simple crescents, very similar to those of rhinoceroses, but the hinder crescent of the third of the series is more elongated.

The dentition may apparently be represented by the formula, $i\frac{1}{3}$, $c\frac{0}{1}$, $p\frac{2}{1}$, $m\frac{3}{3}$; the premolars being separated from the incisors or canines by a long gap.

The front of the apex of the upper tusk is worn to an oblique facet by the attrition of the lower canine. In the lower jaw the tusk is considerably smaller

LOWER JAW OF THE ASTRAPOTHERE (much reduced).

than in the upper jaw, but is still triangular in section, although with the sharp edge in front. The inner surface is concave anteriorly and convex posteriorly; while the outer one is wholly convex, and passes imperceptibly into the small hinder surface. The extremity of the latter is worn into a long oblique facet, in the same manner as in the corresponding tooth of a peccary. The six lower incisors are inclined forwards, and arranged in a circle so as to fill up the interval between the tusks. Their crowns, which, vary in shape in the two species of the genus, are short and spatulate, with the upper surface slightly concave, and the lower one convex; a deep longitudinal groove traversing the middle of each of these two surfaces, and uniting in a notch in the middle of the unworn crown. The lower cheek-teeth call for no special remark, as they are very similar to those of the rhinoceroses. In the lower jaw, the tusks certainly correspond to the canines; and it would appear at first sight that the same would hold good with those of the upper jaw, but from the analogy of the proterothere it is more probable that the latter really belong to the incisor series.

SKELETON OF TOXODON (greatly reduced).

The Toxodonts.

Suborder **Toxodontia.**

The toxodonts may be defined as a group of more or less aberrant Ungulates with tall-crowned and curved cheek-teeth, some or all of which grow from persistent pulps, either permanently or during life; while at least one pair of incisors in each jaw are rootless, and the third upper incisor, when present, is placed in the line of the cheek-teeth. The vertebræ of the neck are short, with flattened articular faces to the bodies, and the vertebral artery piercing the transverse process in the ordinary manner. The wrist (when known) is of the alternating type, while the ankle-joint is formed on the linear plan. The astragalus is slightly grooved on its superior face, and inferiorly is like that of the Odd-toed group, having no head for the navicular; but the calcaneum, which is truncated inferiorly, has a large articular surface for the fibula, as in the Even-toed section. The number of toes varies from five to three; the middle one being larger than either of the others, and symmetrical in itself. The femur may or may not have a third trochanter. The number of trunk-vertebræ in the typical genus is twenty, or intermediate between that of the Even and Odd-toed groups. In form the cheek-teeth of the less specialised forms approximate to the Odd-toed plan of structure; and in all the genera the enamel is most developed on, or even confined to, the outer sides of the cheek-teeth, although there may be vertical bands on some of the other surfaces. More specialised in the structure of the feet and teeth than the last group, phylogenetically the toxodonts may apparently be regarded as related to the Odd-toed Ungulates, but as retaining certain features now common to the Even-toed group, which have probably been inherited from common ancestors.

While, as aforesaid, the more generalised members of the suborder approximate in the structure of their teeth and feet to the Odd-toed group, the specialised forms assume a more or less Rodent-like type of dentition and limb-structure, which must probably be regarded as an instance of parallelism. It may be added that, from the retention of clavicles, these Rodent-like types must be derived from some form less specialised than toxodon, in which those bones have disappeared.

The toxodon was of the size of a large rhinoceros, and characterised by the long and curved crowns of its molar teeth, which continued to grow throughout life. There were only two pairs of incisor teeth and no tusks in the upper jaw, although in the lower jaw the full number of these teeth were developed. The feet were furnished with three toes.

This genus occurs in the superficial deposits of Argentina, but is replaced in the Miocene Tertiaries of Patagonia by certain allied forms known as nesodons, which may be briefly defined as including toxodonts of medium or small size, in which the limbs, and probably also the neck, were relatively longer and more slender than in the typical genus; while all the teeth, with the exception of the second upper and third lower incisors developed roots in the adult state, and the upper molars were of a type approaching that of the Odd-toed group, with a distinct posterior valley, and the middle column forming a distinct lobe projecting

into the median valley. The second upper and the third lower incisors formed a pair of permanently growing tusks, which were, however, not fully developed till late in life.

Even more strange than the toxodon was the smaller typothere of the same region, which represents a remarkable approximation in the characters of its skull and teeth to the Rodents. While the molars were not unlike those of the toxodon, the upper incisors were reduced to a single chisel-shaped pair, and there were no tusks in either jaw. The lower jaw carried one large pair of chisel-like incisor teeth, behind which there came a much smaller second pair. The typothere differed from all living Ungulates, and thereby again resembled Rodents, in having collar-bones (clavicles).

UNDER-SURFACE OF SKULL OF THE NESODON ($\frac{1}{4}$ nat. size).

Finally, certain animals from the Eocene of North America, known as tillodonts, seem to combine the characters of the modern Ungulates, Carnivores, and Rodents, and thus almost defy classification.

The occurrence of all these remarkable Ungulates, so utterly different from those of all other parts of the world, indicates that during the Miocene period South America, with its many peculiar types of Edentates, must have been completely cut off from the northern half of the continent. During the later Pleistocene period, the two areas must, however, have become connected, since at that epoch we first meet with horses, deer, llamas, and other northern types in South America; while some southern forms obtained an entrance into North America.

CHAPTER XXVIII.

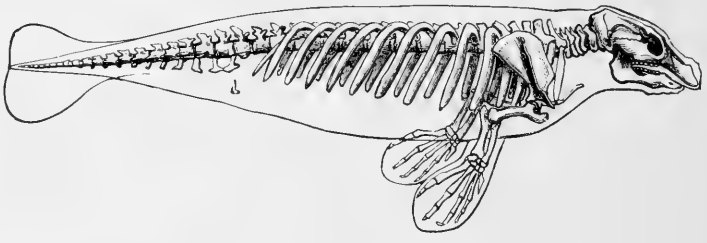
Manatis and Dugongs,—Order Sirenia.

The purely aquatic mammals known as manatis and dugongs, together with the northern sea-cow, which has become extinct within the last century and a half, constitute an order by themselves, and may be collectively known as Sirenians. Although they are as well fitted for an aquatic life as the Cetaceans, these animals have no sort of relationship with the members of that order, and have evidently been derived quite independently from terrestrial mammals. Such resemblances as do exist between Sirenians and Cetaceans are entirely of an adaptive nature, and have been produced merely by the two groups of animals leading a somewhat similar mode of life.

Characteristics. Although the existing Sirenians resemble the Cetaceans in having their fore-limbs converted into flippers, and having lost all traces of the hind-limbs, while the tail is converted into a horizontally-expanded rudder-like organ, comparable to the flukes of the whales and dolphins, their general conformation is very different. In the first place, although the body is somewhat cetacean-like, without any well-defined neck and with no distinction between trunk and tail, it is markedly depressed, instead of being more or less compressed from side to side. Then, again, the head departs but little from the ordinary mammalian type, being comparatively small in proportion to the body, with the summit rounded, and the nostrils, which are double and capable of being closed at will by valve-like flaps, placed above the extremity of the abruptly-truncated muzzle. The back-fin, so commonly present in the Cetaceans, is totally wanting. In the flippers, although the whole of the toes are enclosed in a paddle-shaped mass of integument, traces of nails are still in some cases retained. The eyes are small, with imperfectly-developed lids, and the minute aperture of the ear is unprovided with any external conch. The mouth is small, with thick, fleshy lips, upon which grow a number of bristly hairs, which persist throughout life. The skin is thick, and either finely wrinkled or rugged and bark-like, sometimes with fine hairs thinly distributed upon it. The female has a single pair of teats placed on the breast. The teeth are very variable, being totally wanting in the northern sea-cow, while in the other two living genera they consist of incisors and cheek-teeth. The structure of the cheek-teeth is, however, very different in the two latter, and in one of them their number is much greater than among less aberrant mammals. The living forms have been recently discovered to possess rudimental milk-teeth, and in some extinct species such teeth were well developed. Certain extinct members of the order were, moreover, furnished with a complete set of teeth, comparable to those of ordinary mammals. All the recent

forms have horny plates on the palate and on the opposing surface of the lower jaw.

In the skeleton, the bones are distinguished by their solid and dense structure; this being especially noticeable in those of the skull and in the ribs. The skull is depressed, and has a more or less distinctly deflected beak-like snout, much flattened from side to side. It is further characterised by the very large size of the aperture of the cavity of the nose, which is somewhat pear-shaped, and placed relatively further back than usual. In the living forms the nasal bones were either rudimentary or totally absent; but in some of the fossil species they were better developed, and partially roofed over the nasal cavity in the ordinary manner. This abortion of the nasal bones in both the Sirenians and Cetaceans is doubtless due to the necessity for a large nasal aperture in the skull, owing to the peculiarities in the respiration of these animals. The vertebræ are peculiar in that during the young state they do not show separate plate-like ossifications at each end of their bodies, like those developed in other mammals. Rudiments of these so-called epiphyses have, however, been shown to exist in the extremely young state; and they were more fully developed in certain extinct forms. As in Cetaceans, none of the vertebræ in the hinder region of the trunk unite to form a sacrum; and it is evident that a solid immovable structure in this part of the backbone would be not only a serious disadvantage to a swimming animal, but likewise of no possible use to one which has no hind-limbs to support. Sirenians resemble Ungulates in having no collar-bones. In the fore-limb the upper bone, or humerus, is of considerable length, and differs from that of the Cetaceans in having distinct pulley-like surfaces at its lower end for the articulation of the bones of the fore-arm (radius and ulna), thus permitting of a certain amount of free motion at the elbow-joint. The two bones of the fore-arm are, however, generally united at the lower end. The number of the digits is five, and none of these contains more than the ordinary number of three joints, in addition to the metacarpus. None of the recent Sirenians shows any trace of the hind-limb, although the pelvis is represented by a pair of splint-like bones; but in some fossil forms there was a rudimentary thigh-bone, or femur.



SKELETON OF MANATI.

There are several peculiarities connected with the soft internal parts; but it will suffice to mention here that the lungs are extremely long and narrow, extending beneath the backbone nearly as far back as the last rib. To permit of this backward extension, the midriff, or diaphragm, is placed very obliquely. The larger arteries of the body form peculiar net-like expansions in certain regions, which render the animals able to remain beneath the surface of the water for a longer period than would otherwise be possible, as partly oxygenated blood can be retained for some time in these structures before it is passed through the heart.

Mode of Life. Although the manatis and dugongs never leave the water, and are as well adapted for an aquatic life as the Cetaceans, yet they cannot swim in the rapid manner characteristic of many of the latter, and are never found inhabiting the open sea. On the contrary, they frequent shallow seas and bays, lagoons, estuaries, and large rivers. As regards their food, these animals are entirely herbivorous; browsing upon sea-weeds or other aquatic plants growing beneath the surface of the water. They are slow and sluggish in their movements, while in disposition they are harmless and inoffensive, and appear to be endowed with but a comparatively small amount of intelligence.

Both dugongs and manatis produce but a single offspring at a birth, which is attended with assiduous care by its parent. When suckling, the females raise their heads and breasts above the water, and exhibit the young clinging to them, and partially supported by their flippers; and there can be little doubt but that this habit has given origin to the legendary mermaid. In describing the dugong, Sir Emerson Tennent wrote as follows concerning this point:—"The rude approach to the human outline observed in the shape of the head of this creature, and the attitude of the mother when suckling her young, clasping it to her breast with one flipper, while swimming with the other, holding the heads of both above water; and when disturbed, suddenly diving and displaying her fish-like tail,—these, together with her habitual demonstrations of strong maternal affection, probably gave rise to the fable of the mermaid; and thus that earliest invention of mythical physiology may be traced to the Arab seamen and the Greeks, who had watched the movements of the dugong in the waters of Manaar. Megasthenes records the existence of a creature in the ocean near Taprobane [Ceylon], with the aspect of a woman; and Ælian, adopting and enlarging upon his information, peoples the seas of Ceylon with fishes having the heads of lions, panthers, and rams, and, stranger still, Cetaceans in the form of satyrs. Statements such as these must have had their origin in the hairs which are set round the mouth of the dugong, somewhat resembling a beard, which Ælian and Megasthenes both particularise from their resemblance to the hairs of a woman." The belief in the existence of mermaids was firmly credited by the early Portugese and Dutch voyagers to the East.

Distribution. The living members of the order, which generally associate in small herds, frequent the coasts and larger rivers on both sides of the Atlantic, and also those of the Red Sea, the Indian Ocean, parts of the Bay of Bengal, and Australia. The northern sea-cow was, however, an inhabitant of the cold regions of Behring Sea; and during the Tertiary period Sirenians were distributed over the greater part of the globe. The group is, therefore, evidently a waning one. From their herbivorous habits and the structure of their molar teeth the suggestion naturally arises that the Sirenians are connected with the Ungulates; and the resemblances of their teeth are nearer to the Even-toed than to the Odd-toed section of that order. The retention of five toes by the Sirenians seems, however, to indicate that if they are really connected with the Ungulates, they must have diverged from that group at a very early period of its existence.

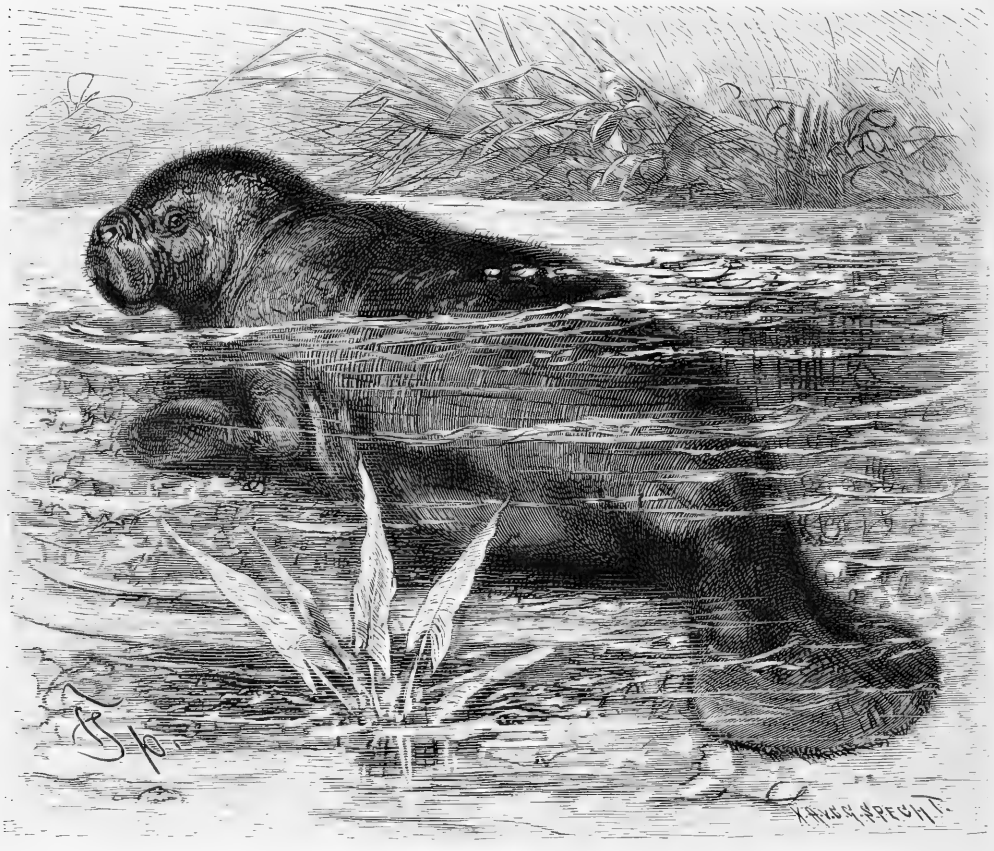
Classification. It has been very generally considered that each of the three genera of Sirenians that have existed during the historic period is entitled to constitute a family by itself. The whole are, however, so nearly allied,

and are so closely connected by fossil forms, that it seems preferable to follow Mr. Blanford in regarding them as members of a single family—the *Halicoridæ*.

The Manatis.

Genus *Manatus*.

The manatis—so named from the hand-like use of the flippers when nursing the young—are characterised by the nostrils being situated at the apex of the



AMERICAN MANATI ($\frac{1}{20}$ nat. size).

muzzle, by the rounded margin of the expanded tail, and the usual presence of three minute rudimentary nails on each of the flippers. In the skull, the beak and extremity of the lower jaw are comparatively small, and but very slightly bent downwards. The incisor teeth are rudimentary, being concealed beneath the horny plates of the mouth, and disappearing before the animal becomes adult. The cheek-teeth, of which eleven are developed on each side of the jaws, have squared crowns, with transverse ridges, thus presenting some resemblance to the lower teeth of the tapir. Generally there are seldom more than six of these teeth in use at the same time on one side of each jaw; the front ones falling out before those further back

have come into use. In the skeleton the manatis present the remarkable peculiarity of having only six vertebræ in the neck; and are thereby almost unique among mammals.

Manatis, when full grown, attain a length of about 8 feet. Their dark, greyish coloured skin is marked by a number of fine wrinkles; and, at least in the young condition, is covered with a number of very fine, sparsely-distributed hairs.

One of the most peculiar features connected with the manatis is to be found in the conformation of the mouth. On this point the late Professor Garrod observes that "the upper lip is prehensile; in other words, the animal is able, by its unaided means, to introduce food placed before it into the mouth without the assistance of the comparatively insignificant lower lip." The front of the muzzle of the manati is of a triangular form, with the apex, in which are situated the nostrils, upwards. The lower border of this triangle is bounded by two rounded fleshy pads, forming the angles of the upper lip. These lip-pads can be either approximated to one another, or widely separated, at the will of their owner. "When the animal," writes Professor Garrod, "is on the point of seizing, say a leaf of lettuce, the pads are diverged transversely in such a way as to make the median gap of considerable breadth. Directly the leaf is within grasp, the lip-pads are approximated, the leaf is firmly seized between their contiguous bristly surfaces, and then drawn inwards by a backward movement of the lower margin of the lip as a whole. The appearance produced by the movements of this peculiar organ is very much the same as that of the mouth in the silkworm and other caterpillars whilst devouring a leaf, the jaws in these insects diverging and converging laterally, in a very similar manner during mastication." In regard to the mechanism for closing the nostrils during submersion, the same writer adds that "these circular orifices have each a flap-valve, which forms the floor or inferior wall of the nasal tubes when the animal is breathing, but which rises and completely occludes it when closed."

Distribution and Number of Species.

Manatis are found in the rivers and on the coasts of the two sides of the tropical portions of the Atlantic; but are mainly fluviatile, ascending the larger rivers, such as the Amazon, almost to their sources. There appear to be three well-defined species, namely, the American manati (*M. americanus*), the African manati (*M. senegalensis*), readily distinguished from the former by the characters of the skull, and the nailless manati (*M. inunguis*), from the Amazon and Orinoco.

Habits.

Owing to the constant persecution for the sake of their oil and hides, manatis have been of late years much diminished in numbers, and in most accessible districts they are now becoming comparatively scarce animals. Their general habits are those noticed under the head of the order; but some more minute observations, which have been gathered from captive specimens, may be noticed in detail. The first living manati brought to England was received in the Zoological Gardens early in August 1875, but did not long survive; and a second specimen was obtained in March 1889. A third lived in the Brighton Aquarium for upwards of sixteen months. All these animals were fed chiefly upon lettuce, although they would also eat other vegetables. The following observations were made by Professor Garrod on the one first acquired by the Zoological Society:—"Looking at the living animal generally, the most striking peculiarity was the

sluggishness of its movements, when crossing its pond there was none of the lateral movement of the body so characteristic of the seals. All flexions were up and down, the whole trunk bending a little in that direction, the base of the tail doing so freely at a clearly-marked transverse fold-line in that region. An opportunity occurred for seeing it out of water, when its pond was drained dry for a short time, From my observations on this occasion, it was perfectly evident that the manati is purely aquatic in habits, and that it never willingly quits the water. When on land, it seemed perfectly unable to advance or recede, the only movements it performed being that from its belly to its back, and *vice versâ*. The power of moving the slightly exserted elbow was considerable, whilst that of the wrist was small but apparent. It used its limbs much more freely than do the seals, sometimes employing the extreme margins of the paddles to assist in introducing food into its mouth, at others employing them in progression along the bottom of the pond, during which time the swimming tail could not be brought into play to any extent."

Beyond the fact that only a single young is produced at a time, there appears to be no accurate observations as to the breeding-habits of the manati; neither are we acquainted with the length of time these animals can remain submerged.

The flesh of the manati, which is very light in colour, is eaten by the natives of the Amazon region, and is compared by Bates to pork. The fat is reported, however, to have a disagreeable flavour.

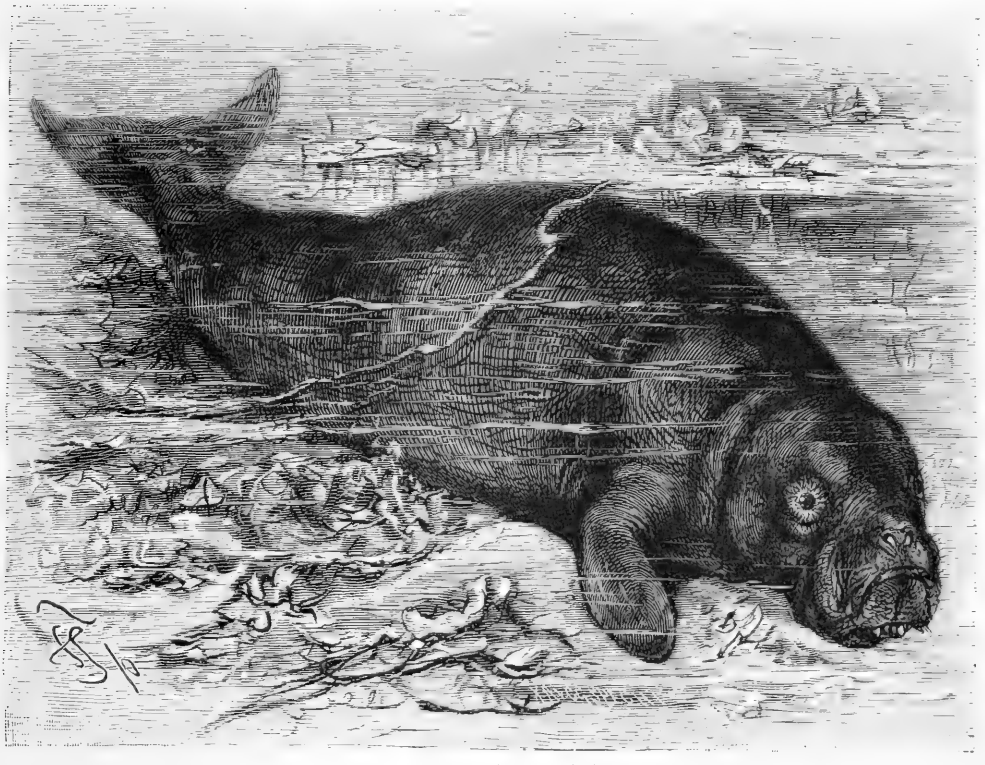
The Dugong.

Genus *Halicore*.

The dugong, or as it should properly be termed, from its Malayan name, duyong, is a very different animal, both externally and as regards the structure of its skull and teeth, from the manati. Externally, it is characterised by the nostrils being situated on the upper part of the muzzle, by the tail being crescent-shaped and concave posteriorly, and by the total absence of any trace of nails on the flippers. The skull is characterised by the great thickness and massiveness of the beak and the extremity of the lower jaw, both of which are sharply bent down, so as to form almost a right angle with the long axis of the skull. The teeth grow throughout life; and in the adult state comprise a pair of incisors in the upper jaw, and five molars on each side of both jaws. In the females, the incisors are small and do not pierce the gum, but in the males they assume the form of rather large and nearly straight tusks, which are partially coated with enamel, and are directed downwards. The molars are cylindrical in form, the last in each jaw being more complex than the others, and looking as if it were composed of two cylinders joined together. These teeth have no enamel; and, as in the manati, some of the front ones are shed before those behind come into use. There can be little doubt but that the molar teeth of the dugong present one step in the process of degeneration which has resulted in their complete disappearance in the northern sea-cow. In colour, the dugong is either uniformly bluish grey, or the under-parts may have a more or less distinct whitish tinge. The normal length attained by these animals varies from

5 to 7 feet, but they occasionally measure from 8 to 9 feet. In a specimen of $8\frac{1}{2}$ feet in length, the maximum girth was 6 feet.

Distribution. Dugongs are found on the shores of the Indian Ocean, for about fifteen degrees on each side of the Equator, from East Africa to Australia, and likewise around the Red Sea. They are not uncommon on parts of the coasts of Ceylon, and around the Andaman and Nicobar Islands. Although it has been considered that the dugong of the Red Sea, and also the one found on the



THE DUGONG ($\frac{1}{30}$ nat. size).

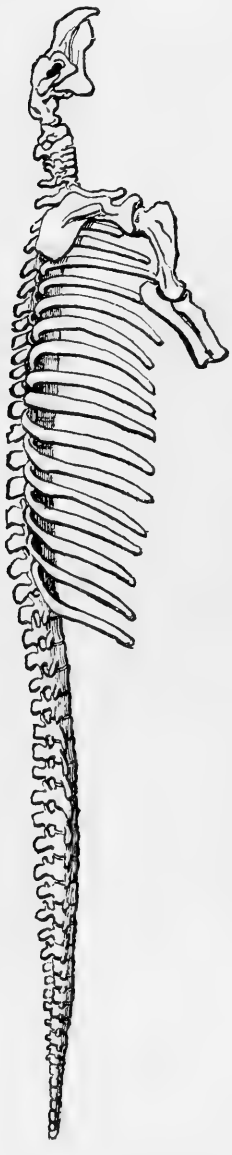
Australian coasts, are specifically distinct from the Indian dugong (*Halicore dugong*), this is extremely doubtful.

Habits. Except that it is a marine animal, never ascending rivers, and feeding chiefly upon seaweed, the dugong appears to be very similar in its general mode of life to the manati. Formerly, these animals are reported to have been found in large herds, comprising several hundreds of individuals, and to have been so fearless of man that they would allow themselves to be touched with the hand. Now, however, they are only to be met with in twos or threes, or small parties; and they have become very shy and wary. Dugong-fishing is practised as a regular industry on the Australian coast; the clear, limpid oil obtained from these animals bearing a high value. The flesh of the dugong is described as being of excellent quality and flavour, by those who have tried it. The natives of Torres Straits, according to the late Professor Moseley, are in the habit of using dugong skulls and ribs for the decoration of their huts.

The Northern Sea-Cow.

Genus *Rhytina*.

On his return in 1741 from a voyage of discovery to Alaska, the navigator Behring had the misfortune to be shipwrecked on the island which now bears his name; that island, together with the adjacent Copper Island, constituting the Commander group, which lie in Behring Sea, at a distance of about one hundred miles from the coast of Kamschatka. At the time of their involuntary sojourn, Behring and his companions found the shores of these islands inhabited by a hitherto unknown animal, evidently allied to the manati, but of much greater dimensions. This creature was the northern sea-cow (*Rhytina stelleri*), then found in vast numbers on the islands in question, but which within a period of thirty years from that date appears to have been totally exterminated by the hand of man. Indeed, had it not been for the fortunate circumstance that Behring was accompanied by the naturalist Steller, we should probably never even have heard of the very existence of this animal, except through some slight mention in the accounts of certain contemporary voyagers. Unfortunately, no skins and only some imperfect skeletons of the animal appear to have been preserved by the survivors of Behring's party; but of late years, a considerable number of more or less imperfect skeletons have been reclaimed from the frozen soil of the Commander Islands.



SKELETON OF THE NORTHERN SEA-COW.

This gigantic Sirenian differed from all its allies in having no teeth, the functions of which were performed by the horny plates covering the palate and opposing surface of the lower jaw. The head was very small in proportion to the body; and the extremities of the jaws were somewhat bent downwards. The tail was forked, after the manner of that of the dugong. The flippers were very small and truncated, and were covered with bristly hairs. Steller expressly states that there were no bones in the hand; and it is certain that none have hitherto been found. The skin was naked, and covered with a thick, rugged epidermis, which was compared to the bark of a tree; in places this epidermis was an inch in thickness, and so tough that it required the use of an axe to cut it. The skin, according to Steller's description, was dark brown in colour, sometimes marked with streaks or spots of white. A drawing of the animal left by Waxell, the navigator of Behring's party, represents it, however, as being marked with alternate dark and light transverse stripes. The skeleton herewith figured measures 19½ feet in length, which would indicate a length of about 20 feet in the

living state; but Steller states that the animal sometimes attained a length of from 25 to 30 feet. The girth of the body was 19 or 20 feet; and the estimated weight 8000 lbs.

Distribution and Habits. With the exception of a single rib from Altu, no remains of the northern sea-cow have been obtained elsewhere than on Barren and Copper Islands. It is, however, almost impossible to believe that such a large animal could always have had such a restricted distribution; and it is hence probable that, when discovered, this Sirenian was already on the wane, and that the Commander Islands were its last resorts from a more extended distribution. Not the least remarkable circumstance connected with this animal is that, although closely allied to the typical dugong, it should have inhabited such a cold and northerly region.

At the time of its discovery by Behring's party, the northern sea-cow was abundant in the bays and river-mouths of the Commander Islands, where it lived in herds of considerable size. It fed chiefly on seaweeds, and more especially on the tangle which grows so abundantly in the northern seas. It was described as a stupid, sluggish, and comparatively helpless animal, which was unable to dive, and was not unfrequently washed ashore by the waves. From its inability to dive, it was compelled to obtain its food in shallow water; and from being often unable to approach the shore during the storms of winter, the animal was generally in poor condition by the spring.

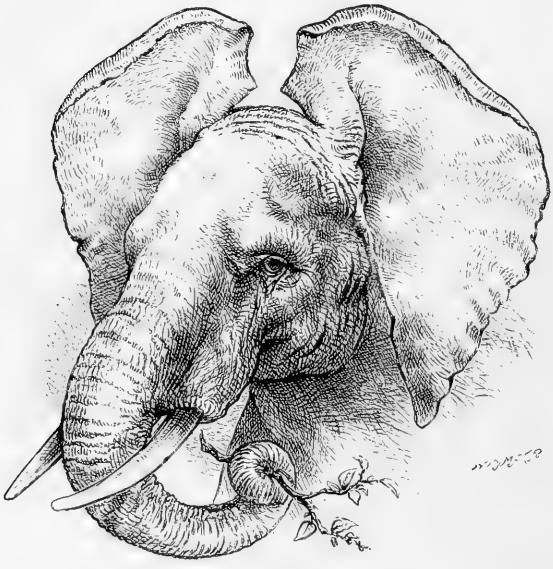
Extermination. Within nine years of its discovery, the northern sea-cow was exterminated on Copper Island; while on Behring Island it had become very scarce by 1763, and the last of its race appears to have been killed in the year 1767 or 1768. It was long thought that the creature was practically exterminated by Behring's party during their sojourn of ten months on the island named after their leader. This, however, was not the case, as they killed but very few. Soon after the return of Behring's crew to Kamschatka several expeditions were fitted out for the purpose of wintering on the Commander Islands and hunting fur-bearing animals; the sea-cows offering the inducement of an abundant supply of fresh food. Ships sailing to Alaska were also in the habit of touching at these islands to take in a supply of salted sea-cow meat. With such stupid and helpless habits as characterised the animal, it is no wonder that its complete extirpation was soon accomplished. Generally the sea-cow was harpooned from a boat; but by approaching stealthily hunters were also enabled to kill them with lances as they lay asleep near the shore.

Tertiary Sirenians.

Throughout a large portion of the Tertiary period various species of extinct Sirenians were common in Europe, and they have also been sparingly met with in England. The best known of these was the halithere (*Halitherium*), which forms in some respects a kind of connecting link between the manati and the dugong. It resembled the latter in having the extremities of the jaws deflected, and in the presence of a pair of tusks in the upper jaw; but its molar teeth were more like those of the manati, although with a pattern recalling that obtaining on the crowns

of those of the hippopotamus. The most interesting points about this animal are the evidences it affords of being a more generalised type than either of its existing allies. Thus the premolar teeth had milk-predecessors, the skull was furnished with distinct nasal bones, and there was a rudimentary hind-limb.

There is, however, another extinct member of the order, which, although unfortunately known only by the skull, presents indications of a still closer affinity with ordinary mammals. This is the *Prorastoma*, of which the remains have been found in strata, probably belonging to the upper portion of the Eocene period in Jamaica and Italy. This creature had three pairs of incisors, and a pair of canines, as well as seven or eight pairs of cheek-teeth in each, and thus approximated very closely to the ordinary mammalian type; the front and premolar teeth doubtless having milk-predecessors. Although, therefore, we have not at present actually succeeded in tracing the origin of the Sirenians into terrestrial mammals, yet we have been able to go such a long way in this direction as to leave no doubt that they have been so derived by some evolutionary process.



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